the cambrian engineering group limited

the cambrian engineering group limited

2200 Argentia Road
Mississauga, Ontario
Canada L5N 2K7
Telephone: (416) 858-8010
Telex: 06-218797

COPY NO. 5

FINAL REPORT

ON
A STUDY INTO THE SEPARATION OF NITROGENOUS MATERIAL FROM NAPHTHA FRACTIONS

NOVEMBER, 1986

MICROMEDIA

DSS File Number 03SQ-23440-4-9176
Contract Serial Number OSQ85-~~0004~~ 00004
Cambrian Project Number C7025
November, 1986

49 pp

The Cambrian Engineering offices are in MISSISSAUGA SASKATOON CALGARY

SUMMARY

The results of this study showed that it is possible to remove the nitrogenous compounds from vaporized model solution by using a combination of zeolite 13X, carbon RZN-1 and montmorillonite clay as adsorbents. However this combination adsorbent column did not work when commercial naphtha fractions were tested. The properties of the naphtha fractions were much more complex than the model solution.

Because of technical difficulties, desorption study using displacement solvent only was investigated. Toluene and isopropanol in vapour and in liquid phases were tested. The results revealed that it is not feasible and economical to desorb the adsorbed nitrogenous compounds from the adsorbents using the present set-up. Large volumes of displacement solvent were required.

TABLE OF CONTENTS

Page

SUMMARY i

TABLE OF CONTENTS ii

1.0 INTRODUCTION 1

2.0 PROJECT APPROACH 2

3.0 LITERATURE REVIEW 3

- 3.1 Molecular Sieves and Clay 5
- 3.2 Metal Halids 9
- 3.3 Ion Exchange Resin 11
- 3.4 Activated Carbon 12
- 3.5 List of Suggested Adsorbent for Screening 13

4.0 EXPERIMENTS AND RESULTS 15

- 4.1 Process and Equipment Description 15
- 4.2 Process Parameters for Adsorption 20
- 4.3 Adsorbents Screening 24
- 4.4 Combination of Adsorbents 27
- 4.5 Movement of Adsorption Front 29
- 4.6 Naphtha Runs 34
- 4.7 Desorption 35
  - 4.7.1 Desorption Using Vapour Phase 35
  - 4.7.2 Desorption Using Liquid Phase 38
- 4.8 Re-Calculation Based on Direct Area Count 40

5.0 CONCLUSIONS AND RECOMMENDATIONS 41

6.0 REFERENCE 43

7.0 APPENDIX 45

1.0 INTRODUCTION

This is a project acquired through a Request For Proposal issued by the Department of Supply and Services Canada for Energy, Mines and Resources Canada.

The purpose of the study was to investigate the use of adsorbents, such as zeolites and clay, to selectively separate the nitrogenous components (N-compounds) from vapourized naphtha fractions. Removal of the N-compounds (typically at levels of over 1,000 ppm N) from the naphtha fractions, obtained after the primary upgrading of bitumen/heavy oils, could significantly reduce the secondary upgrading costs. Therefore, there is a distinct need to develop a viable process to separate the N-compounds from the naphtha fractions.

In addition, it would be desirable to regenerate and reuse the adsorbents after they have become saturated with N-compounds. This will enhance the economic feasibility of the adsorption process. Therefore, the investigation into the desorption process is essential and was included in the study.

This report comprises the review on adsorbents, descriptions of materials and methods used to carry out the study, and the result from this test work.

2.0 PROJECT APPROACH

The two main objectives in this study were:

1) to study the adsorption selectivity of various adsorbents for nitrogenous compounds, commonly found in naphtha fractions, and

2) to determine the efficiency of various desorption methods.

The following tasks were therefore carried out to accomplish the above objectives .

1) To prepare a list of adsorbents for the adsorption study through literature review and discussion with manufacturers

2) To establish optimum adsorption process parameters by using a solution of model N-compounds with a commonly used adsorbent.

3) To study the adsorption selectivity of a number of adsorbents using a solution of model N-compounds and the process parameters developed from the work above

4) To determine the selectivity of the best adsorbent or the adsorbent combinations identified from the previous work, against commercial naphtha fractions containing high levels of N-compounds

5) To evaluate different desorption methods.

3.0 LITERATURE REVIEW

A list of nitrogenous compounds (Table I) which are commonly found in naphtha fractions was supplied by Energy, Mines and Resource Canada. These compounds are predominantly basic and relatively small in molecular size compared to some of the nitrogenous compounds contained in heavier oils. These two characteristics were, therefore, used as a major criteria in selecting a list of adsorbents for the adsorption study.

An online computer search using the CAN/OLE System from CISTI, a division of the National Research Council of Canada, was carried out. It revealed that there are many adsorbents with the ability to absorb nitrogenous compounds. Some adsorbents required more severe process conditions and some required less. Among these adsorbents, five types were considered to be suitable for this study. They were molecular sieves, clays, metal halides, ion exchange resins and activated carbon. The literature findings on each type of adsorbent and the information acquired from the adsorbent manufacturers are presented in the following sections. At the end of Section 3.5, a list of adsorbents (Table II) from these five types was suggested for use in the adsorption study.

TABLE I

NITROGENOUS COMPOUNDS USED IN MODEL SOLUTION

tert-butylamine
tripropylamine
cyclohexylamine
3-ethylpyridine
4-ethylpridine
aniline
2, 4, 6-collidine
1, 2, 5-trimethylpyrrole
benzyl amine
octyl amine
decyl amine

3.1 Molecular Sieves and Clays

The removal of nitrogenous compounds from coker naphtha and hydroprocessed naphtha, using a number of type A and type X zeolites as adsorbents was investigated by G. Jean et al (1). The greatest success was achieved with the use of type 13X zeolites because they had the largest pore size. The greatest trouble arose with the removal of large molecules where the nitrogen was concealed by hydrocarbon rings. However, in naphtha fractions few such large molecules are present. Therefore the 13X zeolite was included in the list of adsorbents for the adsorption study.

The issue of regeneration process for 13X zeolites was discussed with S. Huddleston of Davison Chemicals. The use of water (liquid or vapour) to replace the adsorbed material was not advised because water imposes a substantial loss in adsorbent surface area, hence limiting the potential number of regeneration cycles. In addition, liquid water will also significantly reduce the crush strength of the zeolite.

A better process to regenerate the zeolite would be the thermal swing method. This involves passing a hot neutral gas through the bed to raise its temperature. At 288°C, any adsorbed molecules would be desorbed from the adsorbent. However, if the temperature was raised quickly, the olefins in the naphtha could polymerize, resulting in coke depositing on the adsorbent, sealing its pores, and rendering it inactive. Therefore, the bed should be heated in stages of 38°C per hour. Since frequent exposure to high temperatures will limit the useful life of sieves, it is recommended that temperatures between 149°C and 204°C be used. The bed temperature could also be raised using heating elements and coils. However, since large concentrations of high temperature water would damage the molecular sieves, the bed should not be heated without simultaneous purging with a neutral gas like nitrogen (2). The purge gas should be circulated in the opposite direction to the adsorption gas flow. Following regeneration, the bed should be cooled with either coils or a dry cooling gas. Even if coils are used, a purge gas will help to dissipate the heat more quickly. The cooling gas should be circulated in the same direction as the adsorption gas.

Pressure swing is another method that can be used to regenerate the adsorbent. This process is less expensive and probably causes fewer problems. It involves reducing the pressure in the system to facilitate desorption. Since high operating pressures would promote unwanted adsorption of non-nitrogenous hydrocarbons, the operating pressure for adsorption would probably be only slightly greater than ambient pressure. Desorption would then be achieved by reactor evacuation. An appropriate desorption pressure would be 40 to 70 mmHg, prefereably 70 mmHg, because to draw such a vacuum would require less complicated evacuating equipment. A filter between the reactor and the vacuum source should be installed to trap any zeolite sucked into the vacuum. To optimize the evacuation process, the pressure drop between the vacuum source and the reactor should be limited. The pressure swing process is shorter and simpler than the thermal swing process as no heating and cooling steps are required.

In comparison to the temperature required for desorption (288°C) under normal pressures, the lower temperature required to desorb the naphtha from the adsorbent under pressure swing conditions may not reduce the activity of the zeolite to a significant level. Both zeolites and clays would suffer similar effects and silica gel would even be more sensitive to temperature.

The affinity of molecular sieve 13X for basic compounds can be increased by hydrating the zeolite. This can be achieved by successive washings of the zeolite with water until the pH of the eluted water is constant (3). However, the mechanical strength of the zeolite would be degraded by high water concentrations. An untreated type Y zeolite which has a higher acidity, and a pore size similar to that of type 13X was evaluated, instead (4). In particular, type LZY-52, LZY-72 or LZY-82 was to be examined as they are zeolites with hydrogen cations. The operating conditions and regenerating conditions would be the same with type Y adsorbents as with type X adsorbents. All these zeolites types can be obtained from the Linde Division of Union Carbide. Pellets of 1/16" diameter was considered since larger pellets would give a smaller amount of active surface. On the other hand, pressure drop across a powdered bed would be too great to operate.

Greater success with amorphous silica alumia zeolite as an adsorbent rather then the crystalline X and Y type has been claimed in a United States patent (5). However, the zeolites in the patent were treated with acids. When untreated zeolites are compared, the Y type zeolites with hydrogen have a higher activity (6). Additional silica alumia with high acidity would be investigated in this study if the result from untreated silica alumia zeolites testing is positive.

Amorphous clay is also claimed to be effective on adsorption and yet less expensive (5). Acid activated clay of this kind can be obtained from Harshaw Chemical Co. Probably Grade 24 clay would be suitable, because of its resistance to high temperature.

A method of adsorbing the nitrogenous compounds on various zeolites which have been treated with hydrogen chloride is described by C.A. Audeh (5,7). The process was extremely effective but commercially impractical for a number of reasons. First, the adsorbent production and the adsorption process were very complex and costly. Second, some doubt arose regarding the stability of the acid treatment at high temperatures. Third, the presence of acid posed a hazard to the equipment. Finally, the regeneration process was extensive and expensive as it involved displacing not the nitrogenous compounds but rather the hydrochloride salts of basic compounds. Subsequent acid retreatment of the zeolite was then required. Because of the danger, complexity and commercial impracticality of the process, this acid treated zeolite was not considered at this time.

Similarly, an article by Schmitter et al (8) describes the use of acid treated silica gel to preferentially adsorb basic nitrogenous compounds. The problems of equipment danger, adsorbent instability, and elution of the acid upon regeneration were encountered here also. Hence, this process was not considered either.

3.2 Metal Halides

A number of different metal halides has been tried by Choi et al (9) to complex with basic nitrogenous compounds in an attempt to remove them from their hydrocarbon medium. Of the metal halides tested, some were inexpensive but had a low adsorptive capacity while others had a higher capacity but were more expensive and less available. In a compromise between capacity and cost, $CuCl_2.XH_20$ (where $X \simeq 1.5$) was the most practical and efficient adsorbent. In addition, nickel chloride probably would be another metal halide worth looking at.

Choi's process involved mixing - in a batch process - liquid oil with the metal halide in a 3 to 1 oil/halide weight ratio at 65-80^{o}C. The nitrogenous compounds would then form metal halide complexes that are insoluble in the organic solution. Subsequently, the two phases were separated.

Regeneration of the solid metal halide can be accomplished by one of two processes. Either volatile solvents like acetone or tetrahydrofuran can displace the nitrogenous compounds from the solid, or water can be used to dissolve the complexed molecules. In the former case, the volatile solvents would subsequently be evaporated from the solid while the latter situation requires recrystallization. Unfortunately, with the solvent method, a noticeable diminution in adsorbent capacity was observed with each regeneration. Conversely, regneration by dissolution returns the adsorbent to its original activity.

Along similar lines, Jewell et al (10) supported ferric chloride on Attapulgus clay to remove neutral nitrogenous compounds from a hydrocarbon mixture. Unfortunately, the nitrogenous compounds were complexed to the metal halide so that regeneration of the clay required removal of the complex and therefore the metal halide. The clay then had to be retreated to replace the metal halide.

Also, a number of articles have been found describing methods of suspending metals on X and Y zeolites. Barrer (3) showed the results of adsorption of various amines on different metal treated zeolites. These results indicated that zeolites treated with nickel had the highest amine adsorption capacity (other than hydrogen). Since type X zeolites have a greater number of exchange sites than tvpe Y, the combination of Ni and X zeolite as an adsorbent would be interesting (11).

3.3 Ion Exchange Resin

Ion exchange resins are highly effective in removing nitrogenous compounds but are complex, expensive, and commercially impractical. For comparison purposes, resins should be included in the study.

Since the nitrogenous compounds are basic, Amberlyst A-15 cation exchange resin would probably be suitable. The procedure for pretreating this resin is described by Jewell et al (10) and Sawatzky (12). The resin is washed four times with methanolic hydroxide solution (10% KOH by weight in methanol), then rinsed and soxhlet extracted with methanol. It is then added slowly to a stirred solution of 10% HCl by volume in methanol, followed by washing with distilled water until the washings are neutral to litmus paper. Finally, the resin is soxhlet extracted for 24 hours with methanol, benzene, and pentane and then dried for 24 hours at 40°C in a vacuum oven.

After adsorption, the unreactive material should be eluted with pentane using soxhlet extraction if the feed to the column is liquid. However, with a vapor feed, minimal amounts of untreated fluid will be entrained in the bed.

For column regeneration, the bases can be desorbed by 24 hours elutions with benzene, then methanol, then 8% by volume iso-propylamine in methanol. Between the benzene and methanol elutions, nitrogen should be passed through the bed to loosen the bed. This loosening is necessary to control the methanol-induced swelling which could break the column.

3.4 Activated Carbon

Activated carbon has been widely used as adsorbent for hydrocarbons. The selectivity of oxidized charcoal for nitrogenous compounds was investigated by Burns & Maksimova (13). The study showed that oxidized charocal had a distinct acid character. It was also found that the adsorptive affinity of oxidized charocal for basic groups was greater when compared with unoxidized charcoal.

3.5 LIST OF SUGGESTED ADSORBENT FOR ADSORPTION STUDY

After completion of the literature review, a list (Table II) of adsorbents suggested for the adsorption study was prepared. This list was then sent to Energy, Mines, and Resource for review.

TABLE II

SUGGESTED ADSORBENTS FOR ADSORPTION STUDY

	ADSORBENT	SUPPLIER	REFERENCE
1.	13X	Union Carbide	1,3
2.	LZY52, LZY72, LZY82	Union Carbide	3,4
3.	Silica Alumina	N/A	3,4,5,7
4.	Silica Titania	N/A	4,5,7
5.	Acid Treated Clay	Harshaw Chemicals	3,4,5
6.	$CuCl_2 . 3/2\ H_2O$	BDH Chemicals	9
7.	Nickel Chloride	N/A	9
8.	Ni-X	Union Carbide	3,4,5,9,10
9.	Cation Exchange Resin- Amberlyst A-15	BDH Chemicals	10,12
10.	Oxidized Charcoal	N/A	13

4.0 EXPERIMENTS AND RESULTS

4.1 Process and Equipment Description

The adsorption equipment for nitrogenous compounds was designed and assembled. It involved passing vaporized feed which contains nitrogenous compounds, through a bed of heated adsorbent. The effluent from the column was then condensed and collected into samples for analysis by gas-liquid chromatography (GLC).

A schematic flow diagram for the process described above is shown in Figure I. The existing equipment from Cambrian's laboratory was modified to suit the process. The solvent vaporizer and adsorption column were designed and incorporated into existing equipment. The following paragraphs provide a brief description of the equipment and the process. Also, the sampling procedure and the analytical methodology are described.

A metering pump with explosion proof motor was used to feed solvent from the reservoir into the vaporizer. A pulsation damper after the pump was employed to minimize the pulse effect. Also, a pressure relief valve and a check valve were installed in the line before the vapourizer to release pressure if necessary and to prevent back flow, respectively.

The vaporizer consisted of a 1/8" diameter stainless steel tubing coiled around an electric immersion heater. The whole assembly was then insulated with pipe fiberglass. The temperature of the vaporizer was regulated with a powerstat.

The vapor from the vaporizer is then passed from the bottom through a 30"

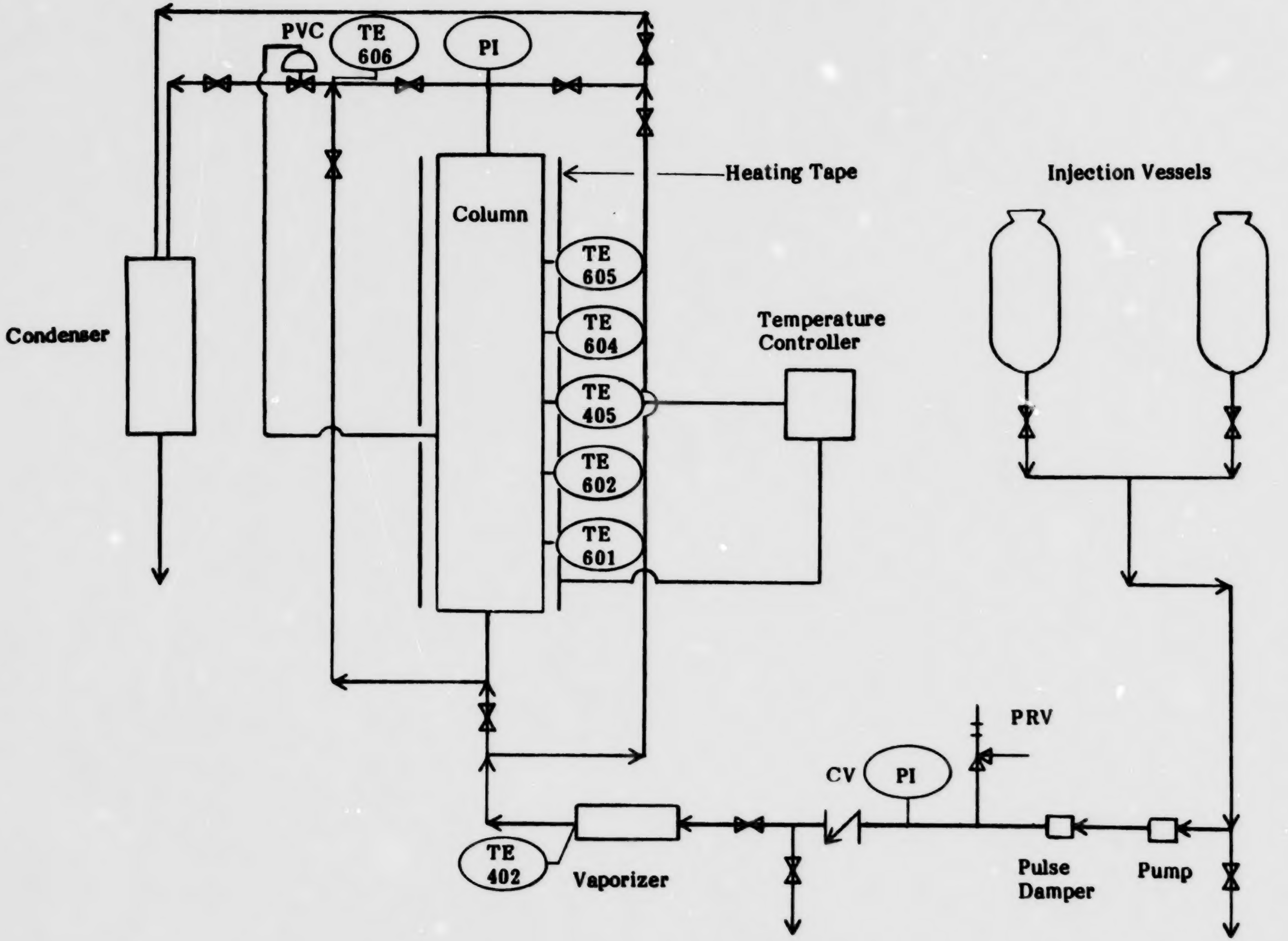

PVC
TE 606
PI
Heating Tape
Injection Vessels
Column
Condenser
TE 605
TE 604
TE 405
TE 602
TE 601
Temperature Controller
PRV
CV
PI
TE 402
Vaporizer
Pulse Damper
Pump

Figure I Schematic Process Flow Diagram

tall 3/8" schedule 40 stainless steel pipe (column), filled with adsorbent. The design criteria for the adsorption column was to maintain a vapour velocity of 1 ft/second passing through the column based on a 3 mL/min. solvent feed rate. In addition, a column L/D ratio of between 50 and 60 was required. The detailed drawing of this column is shown in Figure II. The column was wrapped with electric heating tape and then insulated with pipe fiberglass. A time proportional temperature controller was used to control the column temperature. The temperature profile of the adsorption column was monitored by a series of thermocouples located along the side of the column. In addition, a pneumatic pressure controlling system was used to maintain the pressure in the column during the run.

Vapour effluent from the top of the adsorption column was condensed by refrigerated coolant in a coil type, glass condenser. The effluent was then collected into samples over equal time intervals. The samples from each run were analysed by gas liquid chromatography (Hewlett-Packard 5880A with auto sampler) for nitrogenous compounds. A 30 meter fused silica capillary column coated with a 0.25 micron thick film of DB5 stationary phase was used. The GLC conditions were similar to those used by EMR, as follows:

Sample volume - One Micro-litre
Injection temperature - 250°C
FID director temperature - 350°C
Total carrier gas flow rate - 56 mL/min
Pressure across column - 61.8 kPa
Oven temperature - program 1 - initial value - 60 °C
  - initial time - 5 min
  - program rate - 5°C/min.

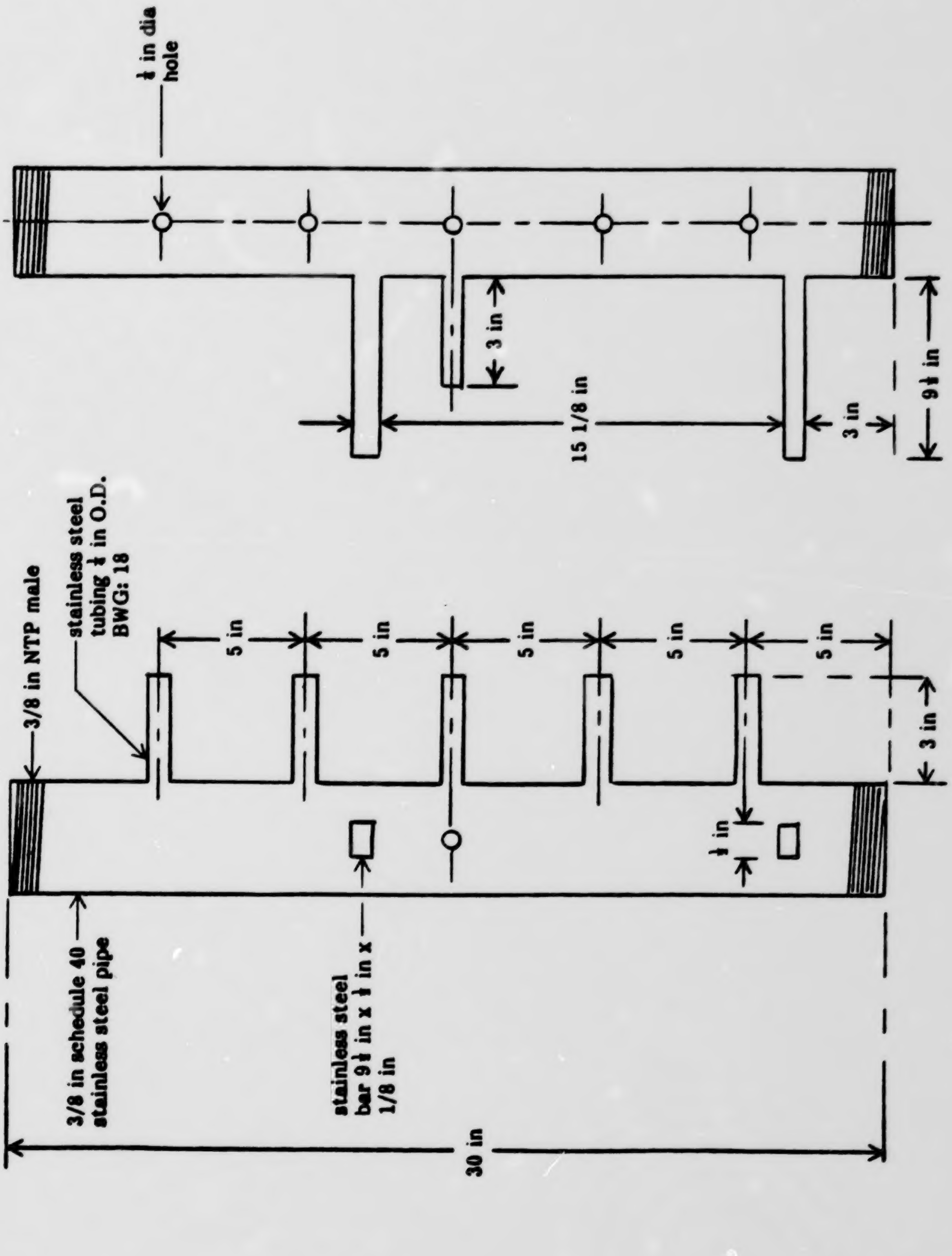

¼ in dia hole
3 in
15 1/8 in
3 in
9¼ in
3/8 in NTP male
stainless steel tubing ¼ in O.D. BWG: 18
5 in
5 in
5 in
5 in
5 in
3 in
¼ in
3/8 in schedule 40 stainless steel pipe
stainless steel bar 9¼ in x ¼ in x 1/8 in
30 in

Figure II Adsorption Column Diamensions

  - final value - 70°C
  - final time - 0 min.
- program 2
  - program rate - 30°C/min.
  - final value - 200°C
  - final time - 1.45 min.

The concentration of each nitrogenous compound (eleven) in the effluent sample was then calculated as a fraction of its concentration in the feed (model run solution). From this data, the nitrogenous compound breakthrough curves for each experiment were then plotted. The computer print out of the data and breakthrough curves for each run were compiled and are presented in the appendix.

The process layout for the unit was also designed to conduct the desorption study. Most of the process lines were 1/4" diameter stainless steel tubing. These lines were insulated with Zetex fabric tape. Some lines were even wrapped with heating tape to prevent the vapor from condensing.

4.2 Process Parameters for Adsorption

Of all the adsorbents reviewed in the literature search, zeolite 13X was found to be the most common and promising one. Adsorbent zeolite 13X was therefore employed in the work to develop the process parameters for nitrogenous compound adsorption.

The eleven nitrogenous compounds (Table I) commonly found in naphtha fraction were used to prepare a stock solution with toluene as solvent. The stock solution was further diluted into the nitrogenous model run solution which contained the same amount of nitrogen for each of the 11 compounds. Initially, a 250 ppm nitrogen (of each compound) model solution was used in the experiment to determine the process parameters for adsorption. With this low nitrogen concentration (250 ppm), it required a longer period of run time to study the adsorption process before breakthrough occurred. Once the process parameters were established, a 1,000 ppm nitrogen model solution was used to shorten the run time required to saturate the adsorbent for each test.

Experiments were designed to investigate three process variables for adsorption. They are the column temperature, pressure and flow rate of model solution. With pressure and flow rate constant, adsorption experiments using three different column temperatures were conducted. The best adsorption temperature of the three was then used to determine the optimum pressure for adsorption, using the same flow rate as before. Of the three pressures tested, the best pressure together with the best temperature for adsorption were then used to determine the effect of flow rate on adsorption. A total of four different flow rate experiments were performed.

For each run, the adsorption column was initially filled with 60 grams of fresh zeolite 13X and heated to temperature. In order compare the GLC results obtained from these experiments, an arbitary criterion was set. The volume of model solution that passed through the column which contained less than 5 ppm N from a particular nitrogenous compound was used to measure the capacity of the adsorbent for that compound. The results of these experiments are summarized and tabulated in Table III. It showed that Run N-22 gave the overall best result for adsorption. The process conditions used in Run N-22 were:

- Nitrogen Concentration of Model Solution - 250 ppm/compound
- Flow Rate of Model Solution - 1 ml/min.
- Pressure in Adsorption Column - 15 psi
- Temperature of Adsorption Column - 250°C
- Run Time - 8 hours

Hence to reduce the run time for 5 ppm nitrogen breakthrough, a 1,000 ppm nitrogen model solution was used in Run N-23 and N-39, otherwise the process conditions were the same as Run N-22. With the 1,000 ppm nitrogen model solution, the run time was reduced from 8 hours (N-22) to 4 hours (N-23 and N-39) before 5 ppm nitrogen breakthrough occured.

The following process conditions for adsorption were then established.

- Nitrogen Concentration of Model Solution - 1,000 ppm/compound
- Flow Rate of Model Solution - 1 ml/min.
- Pressure in Adsorption Column - 15 psi
- Temperature of Adsorption Column - 250°C.
- Run Time - 4 hours

TABLE III

DATA SUMMARY FOR PROCESS PARAMETERS STUDY

						Volume (ml) of Nitrogen Model Solution Before 5 ppm Nitrogen Breakthrough										
Run No.	Adsorbent	Flow Rate (ml/min)	Press (psi)	Temp (°C)	N-Compds Conc. (ppm)	Teritbutyl Amine	Cyclohexyl Amine	Tripropyl Amine	3 Ethyl Pyridine	4 Ethyl Pyridine	Aniline	Collidine	Trimethyl Pyrrole	Benzyl Amine	Octyl Amine	Decyl Amine
N-2	Zeolite 13X	3	Atm.	215	250	270	360 [1]	270	240	255	360 [1]	360[1]	255	360 [1]	315	315
N-5	Zeolite 13X	3	Atm.	250	250	315	375	300	255	255	345	315	255	540 [1]	315	315
N-4	Zeolite 13X	3	Atm.	285	250	330	540 [1]	330	270	285	330	315	270	540 [1]	345	330
N-18	Zeolite 13X	3	15	250	250	270	435	270	285	300	540 [1]	525	285	540 [1]	315	345
N-17	Zeolite 13X	3	30	250	250	270	450	255	285	300	540 [1]	510	285	540 [1]	300	315
N-19	Zeolite 13X	5	15	250	250	175	350	175	250	250	525	375	255	900 [1]	250	275
N-21	Zeolite 13X	2	15	250	250	300	510	290	320	330	600 [1]	590	330	600 [1]	370	380
N-22	Zeolite 13X	1	15	250	250	380	510 [1]	405	425	440	510 [1]	510 [1]	440	510 [1]	505	470
N-23	Zeolite 13X	1	15	250	1,000	155	230	150	175	180	240 [1]	240 [1]	185	175	190	195
N-39	Zeolite 13X	1	15	250	1,000	140	220	140	160	170	230	140	180	170	180	190

[1] No sign of 5 ppm nitrogen breakthrough after passing that volume of nitrogen model solution

The analytical data and nitrogenous compound breakthrough curves resulting from the process parameter study are presented in Section 1 of the Appendix.

4.3 Adsorbents Screening

A list of suggested adsorbents (Table II) for screening, prepared from the literature search was submitted to EMR for approval. With some changes, a new list of adsorbents (Table IV) for screening was suggested by EMR.

The process conditions developed from the process parameter study for adsorption was used to conduct adsorbent screening. These process conditions were as follows:

-	Temperature of Adsorption Column	- 250°C
-	Pressure in the Adsorption Column	- 15 psi
-	Flow Rate of Model Solution	- 1 mL/min.
-	Nitrogen Concentration of Model Solution	- 1,000 ppm/compound
-	Run Time	- 4 hours

A total of 13 adsorbents were screened for their adsorption capacity. With each test, the adsorption column was filled with adsorbent and heated to temperature before passing the vaporized model solution through. The results of these runs are summerized in Table V. It was found that zeolite 13X in general had the highest adsorption capacity. However, for some of the nitrogenous compounds, montmorillonite, carbon RZN-1 and carbon RZN-2 had a higher adsorption capacity than zeolite 13X.

The complete data and breakthrough curves for the adsorbent screening runs are presented in the Appendix, Section 2.

TABLE IV

NEW LIST OF SUGGESTED ADSORBENTS FOR SCREENING

Zeolite 13X
Zelote LZY 72
Zeolite LZY 52
Zeolite LZY 82
Silica Titania
Montmorillonite Clay
Atapulzite Clay
Acid Treated Clay
Ni-X
Cation Exchange Resin - Amberlyst A-15
Synthetic Ion Exchange IRN-77
Synthetic Ion Exchange IRN-78
Synthetic Polymer Adsorbent XAD-12
Oxidized Charcoal

TABLE V

DATA SUMMARY FOR ADSORBENT SCREENING

Run No.	Adsorbent	Flow Rate (ml/min)	Press (psi)	Temp (°C)	N-Compds Conc. (ppm)	Volume (ml) of Nitrogen Model Solution Before 5 ppm Nitrogen Breakthrough										
						Teributyl Amine	Cyclohexyl Amine	Tripropyl Amine	3 Ethyl Pyridine	4 Ethyl Pyridine	Aniline	Collidine	Trimethyl Pyrrole	Benzyl Amine	Octyl Amine	Decyl Amine
N-23	Zeolite 13X	1	15	250	1,000	155	230	150	175	180	240[1]	240[1]	185	175	190	195
N-24	LZY-82	1	15	250	1,000	30	30	30	30	30	30	30	30	35	30	30
N-25	LZY-72	1	15	250	1,000	45	230	210	135	45	45	45	45	45	45	150
N-26	Silica Titania	1	15	250	1,000	60	70	60	60	60	60	60	60	80	110	60
N-27	Montmorillonite	1	15	250	1,000	60	200	240[1]	120	50	50	130	240[1]	60	70	170
N-28	Atapulgite	1	15	250	1,000	80	90	80	60	80	50	60	90	120	130	70
N-29	Carbon RZN-1	1	15	250	1,000	140	90	240[1]	160	170	40	120	240[1]	240[1]	240[1]	240[1]
N-30	Carbon RZN-2	1	15	250	1,000	50	240[1]	120	100	110	80	50	240[1]	240[1]	240[1]	220
N-31	IRN-78	1	15	250	1,000	TOTAL BREAKTHROUGH										
N-32	IRN-77	1	15	250	1,000	TOTAL BREAKTHROUGH										
N-40	LZY-52	1	15	250	1,000	120	190	110	130	120	50	50	50	160	160	50
N-41	Ni-13X	1	15	250	1,000	30	240[1]	200	30	30	30	30	30	170	30	30
N-75	$(SbF_5FSO_3H)13X$	1	15	250	1,000	10	200[1]	70	40	50	50	60	130	170	120	100
N-76	$(SbF_5FSO_3H)13X$	1	15	250	1,000	20	190	80	20	20	20	60	140	30	180	20
N-36	Dehydrated 13X	1	15	250	1,000	90	180	90	130	140	50	50	140	120	150	150

[1] No sign of 5 ppm nitrogen breakthrough after passing that volume of nitrogen model solution

4.4 Combination of Adsorbents

The results of adsorbent screening indicated that carbon RZN-1 and montmorillonite had a higher adsorption capacity for some of the nitrogenous compounds than zeolite 13X. On the other hand, zeolite 13X had a higher adsorption capacity for some of the nitrogenous compounds while carbon RZN-1 and montmorillonite had no adsorption capacity for them at all. Hence, experimental runs using different combinations of these adsorbents were carried out. The results of these combination runs are summarized in Table VI. They show that zeolite 13X, carbon RZN-1 and montmorillonite in combination (Run N-48), with zeolite 13X at the bottom and montmorillonite at the top of the column, had the best adsorption capacity for all of the nitrogenous compounds. The amount of zeolite 13X, carbon RZN-1 and montmorillonite used to prepare the adsorption column were 30 grams, 21 grams and 9 grams, respectively. This adsorbent combination ratio and the process conditions established from the previous process parameters study, were then used in the Naphtha Runs and the Desorption Study.

The data and the nitrogen breakthrough curves for the adsorbent combination runs are presented in the Appendix, Section 3.

TABLE VI

COMBINATION OF ADSORBENTS

Run No.	Adsorbent	Flow Rate (ml/min)	Press (psi)	Temp (°C)	N-Compds Conc. (ppm)	Volume (ml) of Nitrogen Model Solution Before 5 ppm Nitrogen Breakthrough										
						Tertbutyl Amine	Cyclohexyl Amine	Tripropyl Amine	3 Ethyl Pyridine	4 Ethyl Pyridine	Aniline	Collidine	Trimethyl Pyrrole	Benzyl Amine	Octyl Amine	Decyl Amine
N-37	13X 55% of N-23 by weight	1	15	250	1,000	80	130	90	110	110	120	120	110	110	110	110
N-38	RZN-1 45% of N-29 by weight	1	15	250	1,000	70	140	140	80	80	60	60	230	240[1]	150	110
N-33	RZN-1/13X	1	15	250	1,000	140	240[1]	150	150	160	150	150	150	230	220	190
N-34	13X/RZN-1	1	15	250	1,000	160	240[1]	240[1]	220	150	120	110	120	240[1]	240[1]	170
N-47	13X/RZN-1	1	15	250	1,000	90	230	200	150	150	150	130	140	240[1]	240[1]	150
N-35	RZN-1/13X (mix)	1	15	250	1,000	150	240[1]	180	130	200	90	90	90	240[1]	240[1]	130
N-42	RZN-1/13X/Mont.	1	15	250	1,000	130	240[1]	200	140	180	190	180	180	240[1]	180	180
N-48	13X/RZN-1/Mont.	1	15	250	1,000	160	240[1]	230	180	170	180	160	180	240[1]	240[1]	170

[1] No sign of 5 ppm nitrogen breakthrough after passing that volume of nitrogen model solution

4.5 Movement of Adsorption Front

A set of four experimental runs were carried out to study the movement of the adsorption front. To simplify the study, only adsorbent zeolite 13X was used in these runs. Experiments were carried out for a period of one, two, three and four hours. Other process conditions used in these runs were as follows:

- Temperature of Adsorption column	- 250°C
- Pressure in Adsorption column	- 15 psi
- Flow rate of Model solution	- 1 mL/min
- Nitrogen Concentration of Model solution	- 1000 ppm/compound

The condensed effluent samples from these runs were collected and analysed for nitrogenous compounds as before. The results of these runs are summerized in Table VII. The complete data and the nitrogen breakthrough curves from these runs are presented in Section 4 of the Appendix.

The adsorbent column (zeolite 13X) from each test run was divided into four sections. Zeolite 13X from each section was then collected and prepared for nitrogenous compound analysis. The procedure used for sample extraction is outlined below:

1) Grind adsorbent sample into powder
2) Weigh 5.0g of powdered sample into 500 mL round bottom boiling flask
3) Add 2 mL 6 N NaOH, 20 mL tolueue and 50 g distilled water
4) Reflux for 2 hours with magnetic stirring
5) Cool to room temperature

TABLE VII

MOVEMENT OF ADSORPTION FRONT

Run No.	Adsorbent	Flow Rate (ml/min)	Press (psi)	Temp (°C)	N-Compds Conc. (ppm)	Volume (ml) of Nitrogen Model Solution Before 5 ppm Nitrogen Breakthrough										
						Tertbutyl Amine	Cyclohexyl Amine	Tripropyl Amine	3 Ethyl Pyridine	4 Ethyl Pyridine	Aniline	Collidine	Trimethyl Pyrrole	Benzyl Amine	Octyl Amine	Decyl Amine
N-43	13X 4 hrs	1	15	250	1,000	180	240 [1]	170	190	210	120	120	210	200	210	210
N-44	13X 3 hrs	1	15	250	1,000	140	180 [1]	150	150	180 [1]	170	140	180 [1]	170	170	160
N-45	13X 2 hrs	1	15	250	1,000					NO BREAKTHROUGH						
N-46	13X 1 hr	1	15	250	1,000					NO BREAKTHROUGH						

[1] No sign of 5 ppm nitrogen breakthrough after passing that volume of nitrogen model solution

6) Withdraw 5 mL of top layer (Filter the top layer if it appears cloudy or contaminated with powder) into bottle which contains sodium sulphate
7) Shake well and let stand for 10 min.
8) Transfer into vials for GC analysis

The results of nitrogenous compound analysis from each run were then calculated as mg N of each nitrogenous compound adsorbed on each quarter section of the adsorbent column. Data from these runs are tabulated and presented in Table VIII. The data showed that movement of the adsorption front for each nitrogenous compound is different. However, the adsorption fronts can generally be classified into three groups. These are the low, intermediate and high boiling nitrogenous compounds. The low boilers seem to have a fast moving narrow adsorption band while the high boilers have a fast moving broad adsorption front. The intermediate boilers are adsorbed slowly to fill up the column. These results may not be conclusive since some of the low boiling nitrogenous compounds may have escaped from the sample during the extraction process and/or the extraction of some nitrogenous compounds may not have been complete.

TABLE VIII **Movement of Adsorption Front**

N-Compounds	Run Time	mg N adsorbed on ¼ Section of the adsorbent column			
		Top	Top Middle	Bottom Middle	Bottom
Tertbutyl	N-46 - 1 hr	--	--	--	--
Amine	N-45 - 2 hrs	--	--	--	--
	N-44 - 3 hrs	--	0.4	--	--
	N-43 - 4 hrs	0.3	0.3	--	--
Cyclohexyl	N-46 - 1 hr	--	--	2.1	9.7
Amine	N-45 - 2 hrs	--	--	--	--
	N-44 - 3 hrs	--	5.5	--	--
	N-43 - 4 hrs	3.6	9.1	--	--
Tripropyl	N-46 - 1 hr	--	0.5	5.9	0.8
Amine	N-45 - 2 hrs	0.9	--	--	32.7
	N-44 - 3 hrs	--	2.4	0.9	0.5
	N-43 - 4 hrs	3.9	1.0	1.0	--
3-ethyl	N-46 - 1 hr	--	--	--	37.5
Pyridine	N-45 - 2 hrs	0.9	--	--	32.1
	N-44 - 3 hrs	--	1.1	32.3	29.6
	N-43 - 4 hrs	--	16.0	38.3	31.3
4-ethyl	N-46 - 1 hr	--	--	--	40.1
Pyridine	N-45 - 2 hrs	--	--	--	32.1
	N-44 - 3 hrs	--	0.5	15.6	44.4
	N-43 - 4 hrs	--	3.2	40.0	56.6

TABLE VIII **Movement of Adsorption Front** (Cont'd.)

N-Compounds	Run Time	mg N adsorbed on ¼ Section of the adsorbent column			
		Top	Top Middle	Bottom Middle	Bottom
Aniline	N-46 - 1 hr	--	--	--	31.4
	N-45 - 2 hrs	--	--	--	22.1
	N-44 - 3 hrs	--	0.8	15.1	28.7
	N-43 - 4 hrs	--	8.5	23.5	38.2
Collidine	N-46 - 1 hr	--	--	4.0	34.9
	N-45 - 2 hrs	--	--	5.6	28.2
	N-44 - 3 hrs	0.3	22.0	34.7	14.7
	N-43 - 4 hrs	6.4	44.2	23.0	15.4
Trimethyl Pyrrole	N-46 - 1 hr	--	--	--	--
	N-45 - 2 hrs	--	--	--	--
	N-44 - 3 hrs	--	--	--	--
	N-43 - 4 hrs	--	--	--	--
Benzyl Amine	N-46 - 1 hr	--	--	--	23.6
	N-45 - 2 hrs	--	--	--	15.9
	N-44 - 3 hrs	--	--	--	27.8
	N-43 - 4 hrs	--	--	2.8	6.7
Octyl Amine	N-46 - 1 hr	--	--	5.6	4.9
	N-45 - 2 hrs	--	--	4.3	2.7
	N-44 - 3 hrs	3.9	3.5	1.0	1.6
	N-43 - 4 hrs	7.3	1.7	2.7	4.8
Decyl Amine	N-46 - 1 hr	--	--	9.4	8.1
	N-45 - 2 hrs	--	--	5.1	2.9
	N-44 - 3 hrs	5.4	9.7	5.3	3.5
	N-43 - 4 hrs	12.3	4.3	6.7	3.9

4.6 Naphtha Runs

Naphtha fractions from four different sources were used to evaluate the adsorbents and the process conditions for adsorption established from earlier experiments where the nitrogenous model run solution was used. These four naphtha fractions were from Esso, Syncrude, Gulf and Suncor refineries.

Both adsorbent zeolite 13X alone and the combination of zeolite 13X, carbon RZN-1 and montmorillonite were tested with each of the four different naphtha fractions. The process conditions employed in these runs were as follows:

- Flow Rate of Naphtha Fraction	- 1 mL/min.
- Pressure in Adsorption Column	- 15 psi
- Temperature of Adsorption Column	- 250°C.
- Run Time	- 4 hours

The effluent samples from each of the test runs were sent to EMR for total nitrogen analysis. The data is presented in the Appendix, Section 5. The results indicated early nitrogen breakthrough from the adsorption column during the run. Since the characteristics of the naphtha fractions were much more complex than the model solution, the adsorption column might be well suited for the model solution but unsatisfactory for actual naphtha fractions that contain a much wider range of compounds.

4.7 Desorption

4.7.1 Desorption Using Vapour Phase.

Displacement experiments using vapour phase were carried out. The combination of zeolite 13X, carbon RZN-1 and montimorillonite clay as adsorbent was used in this study. The adsorbent was initially adsorbed with nitrogenous compounds by passing the model solution through the column using previously established process condition for adsorption. These process conditions were as follows:

- Temperature of Adsorption column - 250°C
- Pressure in Adsorption column - 15 psi
- Flow Rate of Model Solution - 1 mL/min.
- Nitrogen Concentration of Model Solution - 1000 ppm/compound

Attempts were then made to displace the adsorbed nitrogenous compounds from the adsorbents by passing a displacement solvent (vapour) in the opposite direction through the column. The process conditions used in these desorption runs were as follows:

- Temperature of adsorbent column - 250°C
- Pressure in adsorbent column - Atmospheric
- Flow Rate of displacement solvent - 5m/min.

The effect of four displacement solvents were studied. They were toluene, iso-propanol, chloroform and iso-propylamine. However, the experiments encountered pressure build-up and leaking problems when displacement solvents chloroform and iso-proylamine were investigated. The O-ring and the seal of the pressure relief and check valves were destroyed by these solvents during the runs. Eventuallv, the pressure relief valve broke down and the check valve clogged up. Attempts were made to overcome these difficulties but with no success. Therefore no experimental data are available for the choloroform and iso-proylamine runs.

The analytical data collected from the toluene and iso-propanol runs are summarized and tabulated in Table IX. These results indicated that it is not feasible and economic to displace the adsorbed nitrogenous compounds from the adsorbents in this manner. It requires a large amount of displacement solvent. In addition, it requires a correspondingly large amount of heat to vaporize the displacement solvent. To employ temperatures higher than 250°C in the desorption process might reduce the amount of displacement solvent required, but it would also decompose the nitrogenous compounds. Therefore desorption by thermal means does not appear to be feasible.

The complete data, nitrogen breakthrough curves and nitrogen desorption curves for these runs are presented in Section 6 of the Appendix.

TABLE IX

DESORPTION USING VAPOUR PHASE

Run No.	Adsorbent	Flow Rate (ml/min)	Press (psi)	Temp (°C)	N-Compds Conc. (ppm)	Volume (ml) of Nitrogen Model Solution/Displacement Solvent[6]										
						Tertbutyl Amine	Cyclohexyl Amine	Tripropyl Amine	3 Ethyl Pyridine	4 Ethyl Pyridine	Aniline	Collidine	Trimethyl Pyrrole	Benzyl Amine	Octyl Amine	Decyl Amine
N-57	13X/RZN-1/Mont	1	15	250	1,000	120	240[1]	150	–[2]	130	130	–[2]	110	–[2]	–[2]	140
R-57	Toluene	5	Atm.	250	—	200	400	50	900	900	900	900	250	50	400	150
N-58	13X/RZN-1/Mont	1	15	250	1,000	70	210	160	120	–[2]	130	–[2]	80	240[1]	190	–[2]
R-58	Toluene	5	Atm.	250	—	150	100	100	900	900	900	900	150/750[3]	500/650[3]	200/700[3]	300/800[3]
N-66	13X/RZN-1/Mont	1	15	250	1,000	130	200	150	150	20	150	130	50	240[1]	240[1]	70
R-66	Toluene	5	Atm.	250	—	100	200	150	750	900	900	700	150	350	200	250
N-67	13X/RZN-1/Mont	1	15	250	1,000	130	230[1]	180	160	20	160	160	70	–[2]	–[2]	100
R-67	Toluene	5	Atm.	250	—	150	150	150	750	900	900	700	150	450	150	300
N-63	13X/RZN-1/Mont	1	15	250	1,000	–[2]	220	160	–[2]	–[2]	–[2]	120	110	–[2]	–[2]	–[2]
R-63	Iso-propanol	5	Atm.	250	—	–[4]	900	650	900	900	900	900	650	400	350	350
N-68	13X/RZN-1/Mont	1	15	250	1,000	130	210	210	160	140	150	130	140	–[5]	170	170
R-68	Iso-propanol	5	Atm.	250	—	–[4]	350	350	500	800	700	700	400	200	150	150
N-69	13X/RZN-1/Mont	1	15	250	1,000	–[2]	210	–[2]	120	–[2]	–[2]	100	–[2]	–[5]	–[2]	–[2]
R-69	Iso-propanol	5	Atm.	250	—	–[4]	400	300	900	900	900	900	900	900	100	900

---

[1] No sign of 5 ppm nitrogen breakthrough after passing that volume of nitrogen model solution

[2] Complete breakthrough

[3] Apparent regeneration completed at the first volume, with a sudden surge in nitrogen concentration at 600 ml, followed by completed regeneration at the second volume.

[4] No regeneration

[5] No data

[6] The prefix N and R in the Run No. mean adsorption and desorption respectively. For the adsorption (N) run, this is the volume of nitrogen model solution before 5 ppm nitrogen breakthrough. For the desorption (R) run, this is the volume of displacement solvent which contains more than 1% of the nitrogen in the nitrogen model solution

4.7.2 Desorption using Liquid Phase

Desorption experiments were also carried out in the liquid phase. In addition, adsorption in the liquid phase was investigated. Both zeolite 13X alone and the combination of zeolite 13X, carbon RZN-1 and montmorillonite as adsorbent were tested. The temperature employed in these runs ranged from 250°C to ambient temperature. The column pressure for the adsorption and desorption runs were maintained at 15 psi and atmospheric pressure, respectively. The model solution and displacement solvent flow rates were varied from 1 mL to 5 mL/min. Model solutions with nitrogen concentrations of 200 ppm and 1000 ppm were employed in these runs. Only toluene as displacement solvent was investigated.

The process parameters used in each test run and the resulting data are summarized and tabulated in Table X. The results from these runs showed that carrying out the experiments in the liquid phase did not improve the adsorption or desorption process.

The complete data, nitrogen breakthrough curves and nitrogen desorption curves from these runs are presented in Section 7 of the Appendix.

TABLE X

DESORPTION USING LIQUID PHASE

Run No.	Adsorbent	Flow Rate (ml/min)	Press (psi)	Temp (°C)	N-Compds Conc. (ppm)	Volume (ml) of Nitrogen Model Solution (N)/Toluene (R)										
						Tertbutyl Amine	Cyclohexyl Amine	Tripropyl Amine	3 Ethyl Pyridine	4 Ethyl Pyridine	Aniline	Collidine	Trimethyl Pyrrole	Benzyl Amine	Octyl Amine	Decyl Amine
N-64	13X	2	15	65	1,000	60	160	60	160	160	160	40	40	60	40	40
R-64	Toluene	5	Atm.	65	—	300	300	300	300	300	300	300	300	300	300	300
N-65	13X	2	15	65	1,000	200	200	60	200	200	200	140	60	140	60	60
R-65	Toluene	5	Atm.	Ambient	—	250	200	250	300	300	300	300	300	300	300	300
N-77	13X/RZN-1/Mont (Conditioning 250°C)	1	15	250	1,000	80	240[1]	200	240[1]	180	120	240[1]	120	240[1]	240[1]	60
R-77	Toluene	5	Atm.	70	—	150	–[2]	250	350	400	550	450	200	200	100	200
N-78	13X/RZN-1/Mont	1	15	250	1,000	150	240[1]	240[1]	140	80	190	240[1]	130	110	240[1]	100
R-78	Toluene	5	Atm.	85	—	100	–[2]	150	250	250	900	900	250	150	250	200
N-79	13X/RZN-1/Mont (Conditioning 250°C)	5	15	75	200	550	600	300	400	450	350	350	250	700	450	400
R-79	Toluene	5	Atm.	75	—	900	250	900	900	900	900	900	300	650	300	450
N-80	13X/RZN-1/Mont (Conditioning 200°C)	5	15	110	200	600	1,050[1]	250	450	450	350	300	200	1,050[1]	500	400
R-80	Toluene	5	Atm.	110	—	600	–[2]	250	550	900	900	700	250	350	250	300
N-81	13X/RZN-1/Mont (Reuse of N-80)	5	15	110	200	150	450	100	150	150	50	100	50	450	200	200
R-81	Toluene	5	5	110	—	900	200	250	500	900	900	500	250	450	250	250
N-82	13X/RZN-1/Mont (Conditioning 300°C)	5	15	110	200	200	500	150	350	400	300	250	100	800	300	300
R-82	Toluene	5	Atm.	110	—	900	200	250	900	900	900	900	250	450	250	250

[1] No sign of 5 ppm nitrogen breakthrough after passing that volume of nitrogen model solution

[2] Complete breakthrough

4.8 Re-calculation Based On Direct Area Count

The method used to calculate the N-compound concentration from the chromatograms had thus far taken variations in the amount of sample injected by the autosampler into consideration. Some of the resulting nitrogen breakthrough curves were not smooth. There were large variations in concentration from one sample to the next during the same run. It was thought that the correction made for sample volume injection in the calculation may have actually caused the large variation. Therefore N-compound concentrations of selected test runs were recalculated using direct area count from the chromatogram.

The recalculated data of the selected test runs, and the nitrogen breakthrough and nitrogen desorption curves are presented in Section 8 of the Appendix.

Comparison of these curves to the curves before recalculation showed that recalculation of the N-compound concentration, based on direct area count from the chromatogram, did not reduce the concentration variation from sample to sample. In fact, on most occasions, the variations were worse.

5.0 Conclusions And Recommendations

Experimental work from this study indicated that the combination of zeolite 13X, carbon RZN-1 and montmorillonite clay as adsorbent, with zeolite 13X at the bottom and montmorillonite at the top of the column, had the overall best result in adsorbing nitrogenous compounds from the vaporized model run solution, entering from the bottom of the adsorption column. However, when commercial naphtha fractions were tested instead of model run solution, the results showed early nitrogen breakthrough with the combined adsorbent column. Perhaps, in future studies, commercial naphtha fractions should be used to screen the adsorbents instead of the model run solution, because commercial naphtha fractions behave quite differently to the model run solution. Alternatively, the N-compounds in the model solution should be more representative of those found in commercial naphtha fractions.

The result of desorption study using toluene and iso-propanol as displacement solvents, in vapour and in liquid phases, indicated that it is not effective and economic to displace the adsorbed nitrogenuous compounds from the adsorbents by these methods. It requires a large volume of displacement solvent. In addition, a correspondingly large amount of heat to vaporize the displacement solvent is required.

Future work on vapor phase adsorption of N-compounds should not attempt to directly vaporize the N-compound since the temperatures required will induce changes that will lead to breakdown of the column. The carrier phase should also not be a component of naphtha nor be condensable since this will make the process energy intensive and produce another separation problem. An inert medium like nitrogen should be considered. It can be recycled indefinitely without drawing from the product stream. However, it needs to be carefully scrubbed otherwise it will be a source of product loss. Finally, the particle size of the adsorbent has to be reduced to the powdered form, especially on the laboratory scale. The above should first be investigated directly on the GLC with a packed adsorbent column and with valve switching capability so that effluent samples could either be collected or analyzed on the FID detector. An auto-injector is also needed so that injections on the packed column could be programmed. The GLC should also have electronic flow control so that the carrier gas flow rate could be programmed and optimized. If this system works well for both model solution and naphtha fraction and for both adsorption and regeneration cycles, then scale up to a laboratory scale unit would be warranted.

The above experiments will make use of equipment that is currently in Cambrian's laboratory. A proposal outlining the above change in approach for vapor phase adsorption will be discussed with EMR.

6.0 References

1) Jean, G. et.al., "The Selective Removal of Nitrogenous Compounds From Fuels Using Zeolites" CANMET Energy Research Laboratories. ERP/ERL 84-36.(J)

2) Union Carbide Molecular Sieves For Selective Adsorption, 3rd ed., BDH Chemicals Limited, Poole, England.

3) Barrer, R.M., "Zeolites And Clay Minerals," Academic Press, London, 340-53, 445-48 (1978).

4) Kirk-Othmer, Encyclopaedia of Chemical Technology, "Molecular Sieves," 15(1984) 639, 648, 660.

5) Audeh, C.A., U.S. Patent 4137154, Jan. 30, 1979.

6) Fraissard, J., "Why Are HY Zeolites So Much More Active Than Amorphous Silica-Alumina", Catalysis By Zeolites, Elsevier Scientific Publishing Company, New York, 343-49 (1980).

7) Audeh, C.A., "Removal of Nitrogen Compounds from Lubricating Oils," Ind. Eng. Chem. Prod. Res. Dev., 22(1983) 276-79.

8) Schmitter, Jean-Marie, et.al., "Selective Isolation of Nitrogen Bases From Petroleum," Anal. Chem., 55(1983) 1685-88.

9) Choi, Henry W., and Martin B. Dines, "Selective Removal of Nitrogen Compounds From Shale Oil," Fuels 64(1985).

10) Jewell, D.M. et.al., "Ion Exchange, Coordination and Adsorption Chromatographic Separation of Heavy-End Distillates," Anal. Chem., 44(1972) 1391-95.

11) Breck, D.W., "Ion Exchange Reactions in Zeolites", Zeolite Molecular Sieves: Structure, Chemistry and Use, John Wiley & Sons Inc., 529-92 (1974).

12) Sawatzky, H. et.al, "Separation of Nitrogenous Materials From Bitumen And Heavy Oils," CANMET Energy Research Laboratories.

13) Bruns, B., and M. Maksimova, "The Adsorptive Capacity of Oxidized Charcoal," J. Phys. Chem. (USSR), 4(1933) 228-40.

7.0 Appendix

Volume

1

the cambrian engineering group limited

COPY NO.__________

APPENDIX (VOLUME 1)
FOR FINAL REPORT
ON
A STUDY INTO THE SEPARATION OF NITROGENOUS MATERIAL FROM NAPHTHA FRACTIONS

MICROMEDIA

NOVEMBER, 1986

DSS File Number 03SQ-23440-4-9176
Contract Serial Number OSQ85-~~0004~~ 00004
Cambrian Project Number C7025
November, 1986

161 pp

A STUDY INTO THE SEPARATION OF NITROGENOUS MATERIALS FROM NAPHTHA FRACTIONS
Project Number: C 7025

Section 1: Process Parameters

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-2	13X	3	Atm.	215	250
N-5	13X	3	Atm.	250	250
N-4	13X	3	Atm.	285	250
N-18	13X	3	15	250	250
N-17	13X	3	30	250	250
N-19	13X	5	15	250	250
N-21	13X	2	15	250	250
N-22	13X	1	15	250	250
N-23, N-39	13X	1	15	250	1000

Section 2: Adsorbents

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-24	LZY-82	1	15	250	1000
N-25	LZY-72	1	15	250	1000
N-26	Silica Titania	1	15	250	1000
N-27	Montmorillonite	1	15	250	1000
N-28	Atapulgite	1	15	250	1000
N-29	Carbon RZN-1	1	15	250	1000
N-30	Carbon RZN-2	1	15	250	1000
N-31	IRN-78	1	15	250	1000
N-32	IRN-77	1	15	250	1000
N-40	LZY-52	1	15	250	1000
N-41	Ni-13X	1	15	250	1000
N-75	(SbF5.FSO3H)13X HCOOH	1	15	250	1000
N-76	(SbF5.FSO3H)13X	1	15	250	1000
N-36	Dehydrated 13X	1	15	250	1000

Section 3: Adsorbents (Combination)

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-37	13X, 55% of N-23	1	15	250	1000
N-38	Carbon RZN-1, 45% of N-29	1	15	250	1000
N-33	Carbon RZN-1/13X	1	15	250	1000
N-34, N-47	13X/Carbon RZN-1	1	15	250	1000
N-35	Mix 13X, Carbon RZN-1	1	15	250	1000
N-42	Carbon RZN-1/13X/Montmorillonite	1	15	250	1000
N-48	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000

Section 4: Movement of Adsorption Front

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-43	13X, 4 hrs	1	15	250	1000
N-44	13X, 3 hrs	1	15	250	1000
N-45	13X, 2 hrs	1	15	250	1000
N-46	13X, 1 hr	1	15	250	1000

Section 5: Naphtha Runs

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-49, N1	13X	1	15	250	--
N-50, N1	13X/Carbon RZN-1/Montmorillonite	1	15	250	--
N-51, N2	13X	1	15	250	--
N-52, N2	13X/Carbon RZN-1/Montmorillonite	1	15	250	--
N-53, N3	13X	1	15	250	--
N-54, N3	13X/Carbon RZN-1/Montmorillonite	1	15	250	--
N-55, N4	13X/Carbon RZN-1/Montmorillonite	1	15	250	--
N-56, N4	13X	1	15	250	--

Section 6: Desorption

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-57	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-57	Toluene	5	Atm.	250	--
N-58, N-66, N-67	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-58, R-66, R-67	Toluene	5	Atm.	250	--
N-63, N-68, N-69	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-63, R-68, R-69	Isopropanol	5	Atm.	250	--
N-60, N-70, N-71, N-74	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-60, R-70, R-71, R-74	Chloroform	5	Atm.	250	--
N-72, N-73	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-72, R-73	Isopropyl-amine	5	Atm.	250	--

Section 6: Desorption

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-57	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-57	Toluene	5	Atm.	250	--
N-58, N-66, N-67	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-58, R-66, R-67	Toluene	5	Atm.	250	--
N-60, N-70, N-71, N-74	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-60, R-70, R-71, R-74	Chloroform	5	Atm.	250	--
N-63, N-68, N-69	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-63, R-68, R-69	Isopropanol	5	Atm.	250	--
N-72, N-73	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-72, R-73	Isopropyl-amine	5	Atm.	250	--

Section 7: Desorption (liquid)

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-64	13X	2	15	65	1000
R-64	Toluene	5	Atm.	65	--
N-65	13X	2	15	65	1000
R-65	Toluene	5	Atm.	Ambient	--
N-77	13X/Carbon RZN-1/Montmorillonite /conditoing at 250 C/	1	15	250	1000
R-77	Toluene	5	Atm.	70	--
N-78	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-78	Toluene	5	Atm.	85	--
N-79	13X/Carbon RZN-1/Montmorillonite /conditioning at 250 C/	5	15	75	200
R-79	Toluene	5	Atm.	75	--
N-80	13X/Carbon RZN-1/Montmorillonite /Conditioning at 200 C/ /no water was removed/	5	15	110	200
R-80	Toluene	5	Atm.	110	--
N-81	13X/Carbon RZN-1/Montmorillonite /Reuse of N-80/	5	15	110	200
R-81	Toluene	5	5	110	--
N-82	13X/Carbon RZN-1/Montmorillonite /Conditioning at 300 C/	5	15	110	200
R-82	Toluene	5	Atm.	110	--

Section 8: Re-Calculation*

Run No.	Adsorbent	Flow Rate ml/min	Pressure psi	Temperature C	N-Compounds Concentration ppm
N-22	13X	1	15	250	250
N-23,	13X	1	15	250	1000
N-48	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
N-58, N-66, N-67	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-58, R-66, R-67	Toluene	5	Atm.	250	--
N-63, N-68, N-69	13X/Carbon RZN-1/Montmorillonite	1	15	250	1000
R-63, R-68, R-69	Isopropanol	5	Atm.	250	--

* Calculation based on direct area count.

Run N-2: 13X, 3 ml/min, Atmospheric pressure, 215 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	15	0	0	0	0	0	0	0	0	0	0	0
2	30	0	0	0	0	0	0	0	0	0	0	0
3	45	0	0	0	0	0	0	0	0	0	0	0
4	60	0	0	0	0	0	0	0	0	0	0	0
5	75	0	0	0	0	0	0	0	0	0	0	0
6	90	0	0	0	0	0	0	0	0	0	0	0
7	105	0	0	0	0	0	0	0	0	0	0	0
8	120	0	0	0	0	0	0	0	0	0	0	0
9	135	0	0	0	0	0	0	0	0	0	0	0
10	150	0	0	0	0	0	0	0	0	0	0	0
11	165	0	0	0	0	0	0	0	0	0	0	0
12	180	0	0	0	0	0	0	0	0	0	0	0
13	195	0	0	0	0	0	0	0	0	0	0	0
14	210	0	0	0	0	0	0	0	0	0	0	0
15	225	0	0	0	0	0	0	0	0	0	0	0
16	240	0	0	0	0	0	0	0	0	0	0	0
17	255	0	0	0	0.021514	0.013116	0	0	0.017796	0	0	0
18	270	0	0	0.013532	0.050996	0.030955	0	0	0.058824	0	0	0
19	285	0.099596	0	0.026132	0.086853	0.054565	0	0	0.19476	0	0	0
20	300	1.07537	0	0.050863	0.085259	0.06191	0	0	0.448838	0	0	0
21	315	2.434724	0	0.15399	0.066932	0.056139	0	0	0.672268	0	0	0
22	330	3.161507	0	0.336911	0.051793	0.049318	0	0	0.864064	0	0.195988	0.143101
23	345	3.349933	0	0.631358	0.038247	0.040923	0	0	1.070687	0	0.39892	0.541738
24	360	3.061911	0	0.916472	0.026295	0.03043	0	0	1.172022	0	0.64429	0.443782

Run N-5: 13X, 3 ml/min, Atmospheric pressure, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	15	0	0	0	0	0	0	0	0	0	0	0
2	30	0	0	0	0	0	0	0	0	0	0	0
3	45	0	0	0	0	0	0	0	0	0	0	0
4	60	0	0	0	0	0	0	0	0	0	0	0
5	75	0	0	0	0	0	0	0	0	0	0	0
6	90	0	0	0	0	0	0	0	0	0	0	0
7	105	0	0	0	0	0	0	0	0	0	0	0
8	120	0	0	0	0	0	0	0	0	0	0	0
9	135	0	0	0	0	0	0	0	0	0	0	0
10	150	0	0	0	0	0	0	0	0	0	0	0
11	165	0	0	0	0	0	0	0	0	0	0	0
12	180	0	0	0	0	0	0	0	0	0	0	0
13	195	0	0	0	0	0	0	0	0	0	0	0
14	210	0	0	0	0	0	0	0	0	0	0	0
15	225	0	0	0	0	0	0	0	0	0	0	0
16	240	0	0	0	0	0	0	0	0	0	0	0
17	255	0	0	0	0	0	0	0	0	0	0	0
18	270	0	0	0.014006	0.0825	0.055876	0	0	0.039721	0	0	0
19	285	0	0	0.011671	0.195833	0.130184	0	0	0.144928	0	0	0
20	300	0	0	0	0.24	0.159562	0	0	0.237789	0	0	0
21	315	0	0	0.033613	0.263333	0.175691	0	0	0.389157	0	0	0
22	330	0.098398	0	0.273578	0.245	0.166475	0	0.036925	0.531938	0	0.190397	0.143318
23	345	0.131579	0	0.653128	0.215	0.144009	0.015574	0.093576	0.627483	0	0.653974	0.349903
24	360	0.187643	0	1.042951	0.1525	0.104839	0.031149	0.165402	0.66452	0	1.057119	0.597159
25	375	0.226545	0	1.285714	0.104167	0.070853	0.057755	0.260496	0.676329	0	1.293046	0.811491
26	390	0.302059	0.213184	1.425303	0.074166	0.049539	0.089552	0.353566	0.66452	0	1.413907	1.110394
27	405	0.334096	0.295933	1.480392	0.061666	0.039747	0.126541	0.455119	0.665593	0	1.365066	1.071014
28	420	0.367277	0.364656	1.490663	0.0525	0.032258	0.167424	0.533131	0.660225	0	1.339404	1.188509
29	435	0.389016	0.465638	1.522876	0.05	0.029378	0.234263	0.669196	0.697262	0	1.326159	1.2847
30	450	0.411899	0.553997	1.478525	0.046667	0.025922	0.295912	0.768336	0.692432	0	1.213576	1.199484
31	465	0.430206	0.73913	1.53408	0.059166	0.026498	0.414666	0.96257	0.7343	0	1.226821	1.301485
32	480	0.338673	0.819074	1.430906	0.079166	0.03053	0.512005	1.069803	0.700483	0	1.125	1.21756
33	495	0.250572	0.950912	1.381886	0.010833	0.035138	0.63477	1.227112	0.669351	0	1.052152	0.870239
34	510	0.196796	0.882188	1.221755	0.121667	0.03341	0.734588	1.258978	0.617284	0	0.81043	0.981278
35	525	0.202517	0.820477	1.154995	0.165	0.029954	0.816353	1.304502	0.617284	0	0.734272	0.76501
36	540	0.271167	0.941094	1.245565	0.2275	0.031106	0.995457	1.491148	0.694579	0	0.784768	0.929632

N-4: 13X, 3 ml/min, Atmospheric pressure, 285 C, Standard solution 250 ppm

						C/Co					
ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
15	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0
195	0	0	0	0	0	0	0	0	0	0	0
210	0	0	0	0	0	0	0	0	0	0	0
225	0	0	0	0	0	0	0	0	0	0	0
240	0	0	0	0	0	0	0	0	0	0	0
255	0	0	0	0	0	0	0	0	0	0	0
270	0	0	0	0	0	0	0	0	0	0	0
285	0	0	0	0.026451	0.16685	0	0	0.029323	0	0	0
300	0	0	0	0.062287	0.037675	0	0	0.041456	0	0	0
315	0	0	0	0.102389	0.060818	0	0.009723	0.072801	0.012167	0	0
330	0	0	0	0.112628	0.0662	0.01827	0.035489	0.081395	0.014449	0	0
345	0.261097	0	0.07286	0.106655	0.061356	0.070646	0.190569	0.095551	0	0	0.043331
360	0.386423	0	0.1949	0.102389	0.059203	0.157125	0.433155	0.11729	0	0.174507	0.091401
375	0.33812	0	0.317851	0.101536	0.056512	0.263703	0.715119	0.141557	0	0.314871	0.259986
390	0.347258	0	0.395719	0.101536	0.058127	0.380633	0.924648	0.165319	0	0.401366	0.341909
405	0.334204	0	0.487705	0.118601	0.05436	0.531669	1.263977	0.177958	0	0.423369	0.34868
420	0.234987	0	0.480874	0.127133	0.050592	0.587698	1.311619	0.177958	0	0.377086	0.356804
435	0.174935	0	0.500455	0.150171	0.044672	0.627893	1.359261		0	0.358877	0.397427
450	0.165795	0	0.533698	0.261945	0.057589	0.731425	1.465241	0.219414	0	0.365706	0.440758
465	0.160574	0	0.554189	0.325939	0.059203	0.742387	1.446281	0.226997	0	0.342185	0.40826
480	0.178851	0	0.592896	0.456485	0.070506	0.819123	1.523092	0.247725	0	0.430197	
495	0.214099	0	0.56694	0.567406	0.070506	0.833739	1.485659	0.226491	0	0.42261	0.487475
510	0.174935	0	0.503643	0.640785	0.065662	0.795981	1.370442	0.204247	0	0.372534	0.454976
525	0.127937	0	0.475865	0.700512	0.058665	0.736297	1.260574	0.194135	0	0.271624	0.46784
540	0.110965	0	0.506375	0.860068	0.068353	0.752741	1.26981	0.224469	0	0.305766	0.477319

Run N-18: 13X, 3 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	15	0	0	0	0	0	0	0	0	0	0	0
2	30	0	0	0	0	0	0	0	0	0	0	0
3	45	0	0	0	0	0	0	0	0	0	0	0
4	60	0	0	0	0	0	0	0	0	0	0	0
5	75	0	0	0	0	0	0	0	0	0	0	0
6	90	0	0	0	0	0	0	0	0	0	0	0
7	105	0	0	0	0	0	0	0	0	0	0	0
8	120	0	0	0	0	0	0	0	0	0	0	0
9	135	0	0	0	0	0	0	0	0	0	0	0
10	150	0	0	0	0	0	0	0	0	0	0	0
11	165	0	0	0	0	0	0	0	0	0	0	0
12	180	0	0	0	0	0	0	0	0	0	0	0
13	195	0	0	0	0	0	0	0	0	0	0	0
14	210	0	0	0	0	0	0	0	0	0	0	0
15	225	0	0	0	0	0	0	0	0	0	0	0
16	240	0	0	0	0	0	0	0	0	0	0	0
17	255	0	0	0	0	0	0	0	0	0	0	0
18	270	0	0	0.0183934	0	0	0	0	0	0	0	0
19	285	0.236356	0	0.378205	0	0	0	0	0.00939022	0	0	0
20	300	0.403454	0	0.994774	0.0223449	0.0155429	0	0	0.0333229	0	0	0
21	315	0.536531	0	1.35338	0.0373354	0.0255797	0	0	0.0791373	0	0	0
22	330	0.730208	0	1.37656	0.0455003	0.0303927	0	0	0.127828	0	0.0555536	0
23	345	0.71054	0	1.51583	0.0633156	0.042525	0	0	0.246176	0	0.161586	0
24	360	0.747633	0	1.52801	0.0773674	0.052445	0	0	0.403633	0	0.293214	0.067453
25	375	0.673174	0	1.53671	0.0870083	0.0592212	0	0	0.552614	0	0.457217	0.132833
26	390	0.709203	0	1.36974	0.0813269	0.0556369	0	0	0.590093	0.00703776	0.548278	0.168433
27	405	0.716684	0	1.35474	0.088356	0.0605472	0	0	0.716693	0	0.707148	0.270607
28	420	0.697851	0	1.35665	0.0934242	0.0643071	0	0	0.813396	0.0095933	0.933909	0.417848
29	435	0.605328	0	1.23268	0.0935069	0.0631348	0	0	0.782553	0.00842065	0.918569	0.459729
30	450	0.57959	0.0455836	1.19874	0.0944446	0.0647684	0	0	0.79984	0.00864132	0.963479	0.57206
31	465	0.618778	0.113593	1.15913	0.0888274	0.0617812	0	0	0.793532	0.00875394	0.991422	0.639633
32	480	0.646422	0.171758	1.08488	0.0786119	0.054552	0	0	0.735083	0	0.868186	0.582442
33	495	0.647874	0.284456	1.13765	0.0800867	0.0558576	0	0.00651471	0.805784	0.00864115	0.932557	0.688889
34	510	0.627648	0.424209	1.10569	0.0714752	0.0494744	0	0.01247	0.747017	0.00805411	0.863494	0.657735
35	525	0.669132	0.543099	1.16303	0.0716298	0.0494656	0	0.0187385	0.79584	0	0.903641	0.752885
36	540	0.656318	0.666499	1.0779	0.064918	0.0439133	0	0.029383	0.715376	0	0.751729	0.648888

Run N-17: 13X, 3 ml/min, 30 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	15	0	0	0	0	0	0	0	0	0	0	0
2	30	0	0	0	0	0	0	0	0	0	0	0
3	45	0	0	0	0	0	0	0	0	0	0	0
4	60	0	0	0	0	0	0	0	0	0	0	0
5	75	0	0	0	0	0	0	0	0	0	0	0
6	90	0	0	0	0	0	0	0	0	0	0	0
7	105	0	0	0	0	0	0	0	0	0	0	0
8	120	0	0	0	0	0	0	0	0	0	0	0
9	135	0	0	0	0	0	0	0	0	0	0	0
10	150	0	0	0	0	0	0	0	0	0	0	0
11	165	0	0	0	0	0	0	0	0	0	0	0
12	180	0	0	0	0	0	0	0	0	0	0	0
13	195	0	0	0	0	0	0	0	0	0	0	0
14	210	0	0	0	0	0	0	0	0	0	0	0
15	225	0	0	0	0	0	0	0	0	0	0	0
16	240	0	0	0	0	0	0	0	0	0	0	0
17	255	0	0	0	0	0	0	0	0	0	0	0
18	270	0	0	0.0442581	0	0	0	0	0	0	0	0
19	285	0.0546129	0	0.385325	0.00945579	0.00723755	0	0	0.00896805	0	0	0
20	300	0.132641	0	0.863139	0.0247039	0.0179006	0	0	0.0246651	0	0	0
21	315	0.181425	0	1.2655	0.0532058	0.0378899	0	0	0.0772972	0	0.0692543	0
22	330	0.197747	0	1.39155	0.0888559	0.0635234	0	0	0.184672	0	0.215702	0.0603209
23	345	0.243257	0	1.14237	0.0883533	0.0628541	0	0	0.214336	0	0.243106	0.0726794
24	360	0.208533	0	1.28941	0.116571	0.0838256	0	0	0.330736	0	0.441146	0.125589
25	375	0.217873	0	1.20304	0.119596	0.0866563	0	0	0.399617	0	0.553477	0.232276
26	390	0.270252	0	1.1059	0.115372	0.0827739	0	0	0.425069	0	0.628948	0.301506
27	405	0.228902	0	1.11997	0.123074	0.0885085	0	0	0.493323	0	0.731054	0.347963
28	420	0.220966	0	1.11913	0.122403	0.0881037	0	0	0.536545	0.00816361	0.814092	0.431372
29	435	0.2165	0	1.11879	0.125543	0.090156	0	0	0.593697	0	0.848484	0.504675
30	450	0.264284	0	1.08164	0.120039	0.085792	0	0	0.590504	0	0.84799	0.588166
31	465	0.201748	0.0468127	1.09101	0.123014	0.0878361	0	0	0.612968	0.0086948	0.847416	0.557589
32	480	0.209494	0.100173	1.04969	0.118879	0.0849275	0	0	0.608039	0.00835822	0.828721	0.555887
33	495	0.212193	0.210694	1.04012	0.113739	0.0811438	0	0.00899194	0.602266	0.00836001	0.80205	0.559216
34	510	0.224523	0.278006	1.02652	0.112957	0.0804897	0	0.015987	0.627826	0	0.781732	0.577491
35	525	0.20719	0.454654	1.10055	0.120074	0.0856345	0	0.0322066	0.702414	0	0.845836	0.629737
36	540	0.22964	0.593786	1.01083	0.105934	0.0755365	0	0.049041	0.640585	0	0.70308	0.564967

Run N-19: 13X, 5 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	25	0	0	0	0	0	0	0	0	0	0	0
2	50	0	0	0	0	0	0	0	0	0	0	0
3	75	0	0	0	0	0	0	0	0	0	0	0
4	100	0	0	0	0	0	0	0	0	0	0	0
5	125	0	0	0	0	0	0	0	0	0	0	0
6	150	0	0	0	0	0	0	0	0	0	0	0
7	175	0	0	0	0	0	0	0	0	0	0	0
8	200	0.10595	0	0.0208894	0	0	0	0	0	0	0	0
9	225	0.64335	0	0.323002	0	0	0	0	0.0174878	0	0	0
10	250	1.09905	0	1.03992	0.0185241	0.0131623	0	0	0.0842142	0	0	0
11	275	0.989165	0	1.69955	0.0323246	0.0216741	0	0	0.264078	0	0.185456	0
12	300	0.899904	0	1.84567	0.0413087	0.0264262	0	0	0.526274	0	0.445986	0.206024
13	325	0.86493	0	1.71496	0.0470212	0.028479	0	0	0.84554	0	0.794543	0.399092
14	350	0.788104	0	1.58982	0.0554314	0.0329808	0	0	1.13016	0	1.14165	0.720695
15	375	0.827972	0.0767957	1.44193	0.0564898	0.0337628	0	0	1.16634	0	1.24454	0.90938
16	400	0.835646	0.261355	1.33501	0.0571206	0.0347192	0	0.0201038	1.16532	0	1.30721	1.08449
17	425	0.909742	0.423209	1.22538	0.0496134	0.0322298	0	0.0418879	1.08517	0	1.18694	1.17209
18	450	0.903269	0.606631	1.19872	0.0464357	0.0304335	0	0.0790723	1.05673	0	1.13442	1.20938
19	475	0.979212	0.854206	1.15424	0.0401268	0.0264923	0	0.143289	0.981843	0	1.04046	1.19856
20	500	0.894534	1.15034	1.17278	0.0373614	0.0241868	0	0.258937	0.995874	0	1.00964	1.1512
21	525	0.947997	1.36886	1.16263	0.0361813	0.0217439	0.0171974	0.399936	0.993462	0	1.01324	1.26185
22	550	1.078398	1.440116	1.129249	0.037591	0.0184569	0.0349938	0.5800538	0.9928005	0	0.9534665	1.344838
23	575	0.9848	1.63364	1.15812	0.0513966	0.0166693	0.067799	0.820362	1.02458	0	0.991213	1.22402
24	600	1.04558	1.6644	1.05614	0.0679732	0.0130662	0.100166	0.910572	0.900678	0	0.838666	0.917236
25	625	0.967913	1.7153	1.11177	0.115033	0.0133357	0.178251	1.2084	0.991996	0	0.965068	1.09826
26	650	1.05881	1.65778	1.04363	0.165602	0	0.246754	1.28767	0.917843	0	0.86141	0.975834
27	675	1.22354	1.51203	0.959736	0.218105	0	0.305448	1.26598	0.821937	0	0.742596	0.680096
28	700	1.26739	1.46033	0.9693	0.315521	0.040532	0.420007	1.38753	0.848922	0	0.773739	0.877817
29	725	1.14401	1.45908	1.01006	0.459364	0.0610183	0.569052	1.54788	0.897061	0	0.833326	0.938518
30	750	1.21638	1.38773	0.951525	0.548288	0.084478	0.643811	1.43524	0.824223	0	0.751354	0.838859
31	775	1.05722	1.40386	1.00716	0.749068	0.124741	0.82378	1.52397	0.867904	0	0.815352	0.958054
32	800	0.954166	1.28346	1.03805	0.935826	0.180733	1.0041	1.55513	0.927636	0	0.824808	0.925511
33	825	0.912001	1.29692	1.02401	1.0457	0.212636	1.03126	1.42578	0.866688	0	0.80327	0.80615
34	850	0.985151	1.17317	1.01097	1.14772	0.264003	1.10575	1.37122	0.870973	0	0.810462	0.90243
35	875	1.00085	1.06734	1.03465	1.27513	0.343348	1.23572	1.39477	0.945183	0	0.877685	1.08396
36	900	0.978567	1.04747	1.03577	1.28588	0.34013	1.23431	1.4072	0.932162	0	0.817448	0.94759

Run N-21: 13X, 2 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0	0	0	0	0	0	0	0
6	60	0	0	0	0	0	0	0	0	0	0	0
7	70	0	0	0	0	0	0	0	0	0	0	0
8	80	0	0	0	0	0	0	0	0	0	0	0
9	90	0	0	0	0	0	0	0	0	0	0	0
10	100	0	0	0	0	0	0	0	0	0	0	0
11	110	0	0	0	0	0	0	0	0	0	0	0
12	120	0	0	0	0	0	0	0	0	0	0	0
13	130	0	0	0	0	0	0	0	0	0	0	0
14	140	0	0	0	0	0	0	0	0	0	0	0
15	150	0	0	0	0	0	0	0	0	0	0	0
16	160	0	0	0	0	0	0	0	0	0	0	0
17	170	0	0	0	0	0	0	0	0	0	0	0
18	180	0	0	0	0	0	0	0	0	0	0	0
19	190	0	0	0	0	0	0	0	0	0	0	0
20	200	0	0	0	0	0	0	0	0	0	0	0
21	210	0	0	0	0	0	0	0	0	0	0	0
22	220	0	0	0	0	0	0	0	0	0	0	0
23	230	0	0	0	0	0	0	0	0	0	0	0
24	240	0	0	0	0	0	0	0	0	0	0	0
25	250	0	0	0	0	0	0	0	0	0	0	0
26	260	0	0	0	0	0	0	0	0	0	0	0
27	270	0	0	0	0	0	0	0	0	0	0	0
28	280	0	0	0	0	0	0	0	0	0	0	0
29	290	0	0	0	0	0	0	0	0	0	0	0
30	300	0	0	0	0	0	0	0	0	0	0	0
31	310	0.14446	0	0.414222	0	0	0	0	0	0	0	0
32	320	0.341536	0	0.930922	0	0	0	0	0	0	0	0
33	330	0.426212	0	1.25871	0.0208557	0.0128135	0	0	0.0129288	0	0	0
34	340	0.412954	0	1.43671	0.0357556	0.0221115	0	0	0.0277455	0	0	0
35	350	0.435122	0	1.49143	0.0562714	0.0348009	0	0	0.0521648	0	0	0
36	360	0.45301	0	1.52375	0.0791628	0.0498773	0	0	0.0921924	0	0	0
37	370	0.418927	0	1.5769	0.106953	0.0688059	0	0	0.158747	0	0	0
38	380	0.441332	0	1.53576	0.124053	0.0810507	0	0	0.229914	0	0.0771963	0
39	390	0.55216	0	1.47479	0.134487	0.0891603	0	0	0.310932	0	0.175925	0.0306687
40	400	0.590388	0	1.44414	0.143542	0.0973882	0	0	0.413261	0	0.300732	0.0678743
41	410	0.647795	0	1.40581	0.146328	0.100437	0	0	0.500421	0	0.451085	0.121574
42	420	0.670971	0	1.3275	0.141999	0.0985476	0	0	0.559422	0	0.540023	0.14257
43	430	0.649639	0	1.27473	0.136212	0.0951832	0	0	0.60719	0	0.666364	0.155866
44	440	0.629292	0	1.33769	0.142578	0.100756	0	0	0.720308	0	0.873119	0.144785
45	450	0.684663	0	1.29398	0.137344	0.0963948	0	0	0.746654	0	0.952319	0.39124
46	460	0.637413	0	1.28681	0.13161	0.0928506	0	0	0.77201	0	1.01679	0.444742
47	470	0.68762	0	1.24465	0.122577	0.0865397	0	0	0.759609	0	1.02339	0.484903
48	480	0.698142	0	1.22303	0.116047	0.0818228	0	0	0.754634	0	1.00662	0.540122

Run N-21: 13X, 2 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
49	490	0.682061	0	1.30354	0.117897	0.081789	0	0	0.790622	0	1.04101	0.580768
50	500	0.626856	0	1.27204	0.113879	0.0785602	0	0	0.787529	0	1.01905	0.645746
51	510	0.652059	0	1.28442	0.111676	0.074037	0	0	0.817761	0	1.08474	0.804903
52	520	0.623395	0.171917	1.32871	0.113184	0.0788096	0	0	0.878986	0	1.1989	1.05431
53	530	0.659648	0.19082	1.2133	0.101264	0.0695693	0	0	0.791181	0	0.962583	0.84237
54	540	0.663963	0.248924	1.24058	0.105005	0.0728075	0	0	0.878497	0	1.03744	1.01603
55	550	0.617209	0.432033	1.23867	0.100432	0.0692681	0	0	0.87089	0	1.00381	0.98596
56	560	0.60195	0.621726	1.19428	0.0934682	0.0644329	0	0	0.841144	0	0.944553	0.884361
57	570	0.61542	0.736433	1.18752	0.0907772	0.0625511	0	0	0.852184	0	0.917393	0.88756
58	580	0.614195	0.904806	1.17403	0.087245	0.060312	0	0	0.862213	0	0.904742	0.893842
59	590	0.600343	1.13305	1.24412	0.0879868	0.0611592	0	0.0160567	0.931702	0	0.966447	1.05505
60	600	0.553571	1.27791	1.2339	0.0848278	0.0581047	0	0.0258031	0.917449	0	0.843751	0.874739

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	5	0	0	0	0	0	0	0	0	0	0	0
2	10	0	0	0	0	0	0	0	0	0	0	0
3	15	0	0	0	0	0	0	0	0	0	0	0
4	20	0	0	0	0	0	0	0	0	0	0	0
5	25	0	0	0	0	0	0	0	0	0	0	0
6	30	0	0	0	0	0	0	0	0	0	0	0
7	35	0	0	0	0	0	0	0	0	0	0	0
8	40	0	0	0	0	0	0	0	0	0	0	0
9	45	0	0	0	0	0	0	0	0	0	0	0
10	50	0	0	0	0	0	0	0	0	0	0	0
11	55	0	0	0	0	0	0	0	0	0	0	0
12	60	0	0	0	0	0	0	0	0	0	0	0
13	65	0	0	0	0	0	0	0	0	0	0	0
14	70	0	0	0	0	0	0	0	0	0	0	0
15	75	0	0	0	0	0	0	0	0	0	0	0
16	80	0	0	0	0	0	0	0	0	0	0	0
17	85	0	0	0	0	0	0	0	0	0	0	0
18	90	0	0	0	0	0	0	0	0	0	0	0
19	95	0	0	0	0	0	0	0	0	0	0	0
20	100	0	0	0	0	0	0	0	0	0	0	0
21	105	0	0	0	0	0	0	0	0	0	0	0
22	110	0	0	0	0	0	0	0	0	0	0	0
23	115	0	0	0	0	0	0	0	0	0	0	0
24	120	0	0	0	0	0	0	0	0	0	0	0
25	125	0	0	0	0	0	0	0	0	0	0	0
26	130	0	0	0	0	0	0	0	0	0	0	0
27	135	0	0	0	0	0	0	0	0	0	0	0
28	140	0	0	0	0	0	0	0	0	0	0	0
29	145	0	0	0	0	0	0	0	0	0	0	0
30	150	0	0	0	0	0	0	0	0	0	0	0
31	155	0	0	0	0	0	0	0	0	0	0	0
32	160	0	0	0	0	0	0	0	0	0	0	0
33	165	0	0	0	0	0	0	0	0	0	0	0
34	170	0	0	0	0	0	0	0	0	0	0	0
35	175	0	0	0	0	0	0	0	0	0	0	0
36	180	0	0	0	0	0	0	0	0	0	0	0
37	185	0	0	0	0	0	0	0	0	0	0	0
38	190	0	0	0	0	0	0	0	0	0	0	0
39	195	0	0	0	0	0	0	0	0	0	0	0
40	200	0	0	0	0	0	0	0	0	0	0	0
41	205	0	0	0	0	0	0	0	0	0	0	0
42	210	0	0	0	0	0	0	0	0	0	0	0
43	215	0	0	0	0	0	0	0	0	0	0	0
44	220	0	0	0	0	0	0	0	0	0	0	0
45	225	0	0	0	0	0	0	0	0	0	0	0
46	230	0	0	0	0	0	0	0	0	0	0	0
47	235	0	0	0	0	0	0	0	0	0	0	0
48	240	0	0	0	0	0	0	0	0	0	0	0

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
49	245	0	0	0	0	0	0	0	0	0	0	0
50	250	0	0	0	0	0	0	0	0	0	0	0
51	255	0	0	0	0	0	0	0	0	0	0	0
52	260	0	0	0	0	0	0	0	0	0	0	0
53	265	0	0	0	0	0	0	0	0	0	0	0
54	270	0	0	0	0	0	0	0	0	0	0	0
55	275	0	0	0	0	0	0	0	0	0	0	0
56	280	0	0	0	0	0	0	0	0	0	0	0
57	285	0	0	0	0	0	0	0	0	0	0	0
58	290	0	0	0	0	0	0	0	0	0	0	0
59	295	0	0	0	0	0	0	0	0	0	0	0
60	300	0	0	0	0	0	0	0	0	0	0	0
61	305	0	0	0	0	0	0	0	0	0	0	0
62	310	0	0	0	0	0	0	0	0	0	0	0
63	315	0	0	0	0	0	0	0	0	0	0	0
64	320	0	0	0	0	0	0	0	0	0	0	0
65	325	0	0	0	0	0	0	0	0	0	0	0
66	330	0	0	0	0	0	0	0	0	0	0	0
67	335	0	0	0	0	0	0	0	0	0	0	0
68	340	0	0	0	0	0	0	0	0	0	0	0
69	345	0	0	0	0	0	0	0	0	0	0	0
70	350	0	0	0	0.00823239	0	0	0	0	0	0	0
71	355	0	0	0	0.00752713	0	0	0.0219821	0	0	0	0
72	360	0	0	0	0.00949194	0	0	0.0223393	0	0	0	0
73	365	0	0	0	0.00783612	0	0	0.0181588	0	0	0	0
74	370	0	0	0	0.00864243	0	0	0.0219113	0	0	0	0
75	375	0	0	0	0.00943797	0	0	0.0257468	0	0	0	0
76	380	0	0	0	0.0211219	0	0	0.0232292	0	0	0	0
77	385	0.0892265	0	0	0	0	0	0.0180822	0	0	0	0
78	390	0.166225	0	0	0	0	0	0.0177358	0	0	0	0
79	395	0.251085	0	0	0	0	0	0.0212688	0	0	0	0
80	400	0.294976	0	0	0	0	0	0.0203428	0	0	0	0
81	405	0.357516	0	0	0	0	0	0.0251233	0	0	0	0
82	410	0.412177	0	0.0268638	0	0	0	0.0251491	0	0	0	0
83	415	0.454187	0	0.0647124	0	0	0	0.0200745	0	0	0	0
84	420	0.510988	0	0.13436	0	0	0	0.0221152	0	0	0	0
85	425	0.574113	0	0.216904	0	0	0	0.017095	0	0	0	0
86	430	0.498759	0	0.358905	0.0336112	0	0	0.0240262	0	0	0	0
87	435	0.412017	0	0.5046	0.0493859	0.0163139	0	0.0346927	0	0	0	0
88	440	0.36132	0	0.53546	0.0443898	0.0191158	0	0.0238909	0.0185985	0	0	0
89	445	0.305121	0	0.67123	0.0608182	0.0268151	0	0.0349947	0.0260726	0	0	0
90	450	0.291901	0	0.646684	0.0628776	0.0288233	0	0.0326846	0.0289109	0	0	0
91	455	0.231343	0	0.681952	0.0702073	0.0353156	0	0.0318886	0.0298358	0	0	0
92	460	0.212866	0	0.663304	0.0745804	0.0388771	0	0.032204	0.0355116	0	0	0
93	465	0.260451	0	0.564269	0.0688322	0.0375037	0	0.0240154	0.0334439	0	0	0
94	470	0.263123	0	0.592783	0.0758747	0.0451625	0	0.0232439	0.0421141	0	0	0
95	475	0.202421	0	0.732254	0.114397	0.0601747	0	0.0674354	0.0654194	0	0	0.0792678
96	480	0.214357	0	0.608757	0.0957225	0.0534269	0	0.0426622	0.0552454	0	0	0.0619575

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
97	485	0.165048	0	0.630264	0.101508	0.0607461	0	0.0351951	0.0648045	0	0	0.0916279
98	490	0.16481	0	0.59063	0.0975017	0.0593607	0	0.0290706	0.061887	0	0	0.0686135
99	495	0.209949	0	0.542878	0.0907158	0.0570766	0	0.0231106	0.0603847	0	0	0.0623641
100	500	0.183097	0	0.603105	0.106629	0.0648524	0	0.0339617	0.0733658	0	0	0.106093
101	505	0.173909	0	0.605027	0.111629	0.069155	0	0.033903	0.0797134	0	0	0.147036
102	510	0.186021	0	0.565618	0.103762	0.0647174	0	0.0244517	0.0761617	0	0.13595	0.119218

Run N-23: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

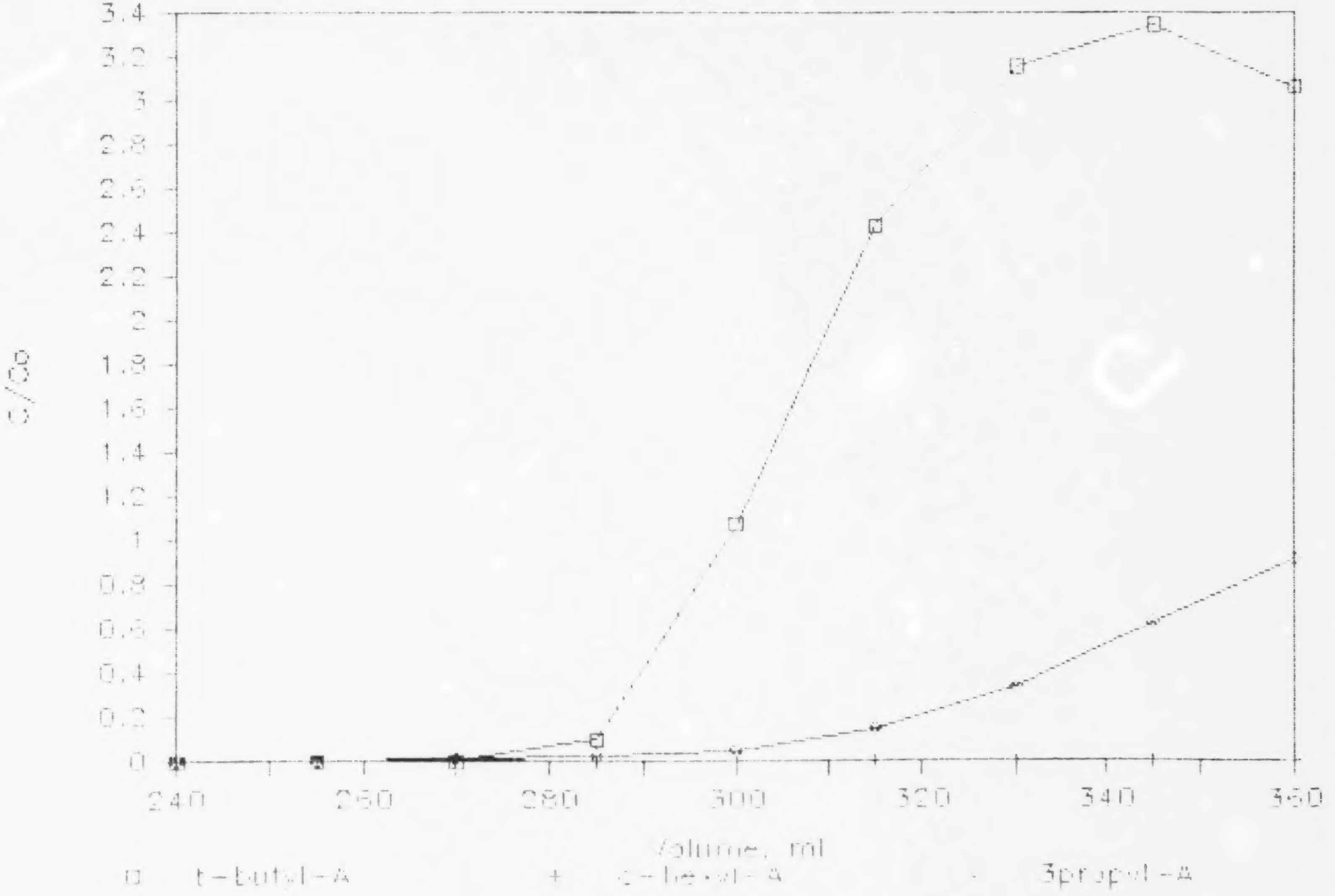
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	5	0	0	0	0	0	0	0	0	0	0	0
2	10	0	0	0	0	0	0	0	0	0	0	0
3	15	0	0	0	0	0	0	0	0	0	0	0
4	20	0	0	0	0	0	0	0	0	0	0	0
5	25	0	0	0	0	0	0	0	0	0	0	0
6	30	0	0	0	0	0	0	0	0	0	0	0
7	35	0	0	0	0	0	0	0	0	0	0	0
8	40	0	0	0	0	0	0	0	0	0	0	0
9	45	0	0	0	0	0	0	0	0	0	0	0
10	50	0	0	0	0	0	0	0	0	0	0	0
11	55	0	0	0	0	0	0	0	0	0	0	0
12	60	0	0	0	0	0	0	0	0	0	0	0
13	65	0	0	0	0	0	0	0	0	0	0	0
14	70	0	0	0	0	0	0	0	0	0	0	0
15	75	0	0	0	0	0	0	0	0	0	0	0
16	80	0	0	0	0	0	0	0	0	0	0	0
17	85	0	0	0	0	0	0	0	0	0	0	0
18	90	0	0	0	0	0	0	0	0	0	0	0
19	95	0	0	0	0	0	0	0	0	0	0	0
20	100	0	0	0	0	0	0	0	0	0	0	0
21	105	0	0	0	0	0	0	0	0	0	0	0
22	110	0	0	0	0	0	0	0	0	0	0	0
23	115	0	0	0	0	0	0	0	0	0	0	0
24	120	0	0	0	0	0	0	0	0	0	0	0
25	125	0	0	0	0	0	0	0	0	0	0	0
26	130	0	0	0	0	0	0	0	0	0	0	0
27	135	0	0	0	0	0	0	0	0	0	0	0
28	140	0	0	0	0	0	0	0	0	0	0	0
29	145	0	0	0	0	0	0	0	0	0	0	0
30	150	0	0	0	0	0	0	0	0	0	0	0
31	155	0	0	0.051796	0	0	0	0	0	0	0	0
32	160	0.0055871	0	0.426685	0	0	0	0	0	0	0	0
33	165	0.0284014	0	1.149179	0	0	0	0	0	0	0	0
34	170	0.24418	0	1.390527	0	0	0	0	0	0	0	0
35	175	0.169943	0	1.596716	0	0	0	0.003015	0	0	0	0
36	180	0.211846	0	1.563886	0.005529	0	0	0.002697	0	0.005092	0	0
37	185	0.255819	0	1.488132	0.014242	0.005365	0	0.002539	0.00298	0.007716	0	0
38	190	0.423176	0	1.398957	0.043063	0.018453	0	0	0.016463	0.010802	0	0
39	195	0.458613	0	1.394299	0.097184	0.046983	0	0.003015	0.065285	0.013734	0.056208	0
40	200	0.4806	0	1.257985	0.149631	0.083758	0	0.002856	0.169315	0.013734	0.178691	0.039189
41	205	0.364718	0	1.267524	0.214142	0.140819	0	0.003015	0.415129	0.015123	0.540687	0.147447
42	210	0.422917	0	1.091282	0.197386	0.147755	0	0	0.609707	0.012808	0.819211	0.252402
43	215	0.393688	0	1.07531	0.174262	0.140295	0	0.003491	0.797757	0.008796	1.068931	0.31096
44	220	0.347904	0	0.933673	0.132875	0.106007	0	0	0.784416	0.008179	1.087108	0.333783
45	225	0.363683	0	0.911601	0.11947	0.091349	0	0	0.810388	0.00787	1.073685	0.345195
46	230	0.387221	0	0.91027	0.109752	0.082449	0	0	0.821175	0.007417	1.050615	0.391291
47	235	0.399637	0.029587	0.959183	0.106233	0.079308	0	0	0.866874	0.007716	1.04628	0.445195
48	240	0.549146	0.083865	0.915261	0.088974	0.06609	0	0	0.78839	0.007253	0.923098	0.457507

Run N-39: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm (Repeat of Run N-23)

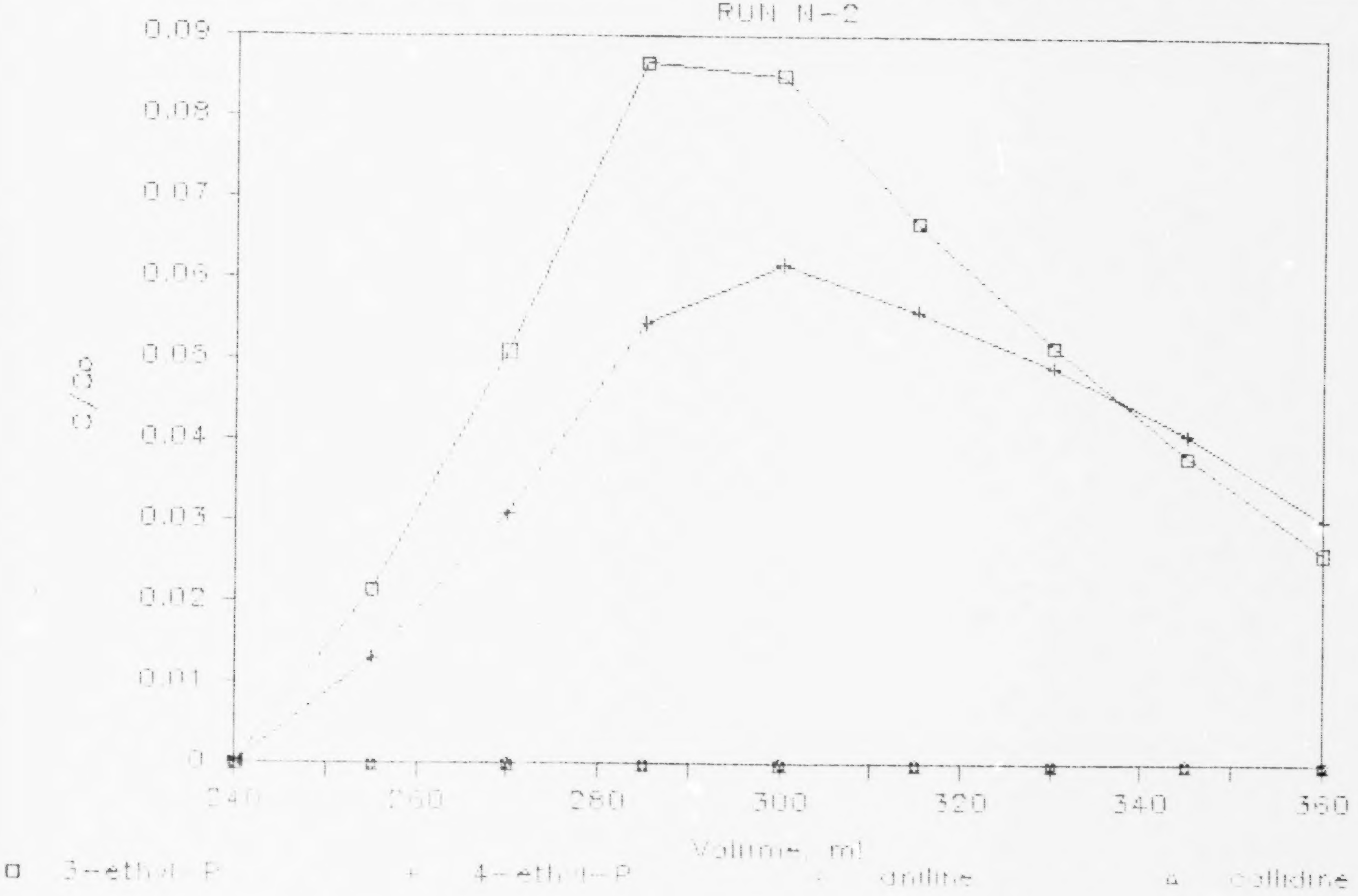
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0.044125	0.087019	0.049761	0.861678	0.829008	0.57039	1.037259	0.235775	0	0.014952	0.505093
5	50	0.013524	0	0	0.046761	0.056581	0.046144	0.090082	0.034545	0	0	0.052843
6	60	0.008409	0	0	0.030373	0.03642	0.054615	0.076131	0.02254	0	0	0.024731
7	70	0	0	0	0.008969	0.017297	0.032336	0.029013	0.012398	0	0	0.017404
8	80	0	0	0	0	0.008087	0.017562	0.015329	0.006218	0	0	0.013278
9	90	0	0	0	0	0.009336	0.02016	0.016896	0.009053	0	0	0.023757
10	100	0.004837	0	0	0	0.010914	0.024041	0.020762	0.010927	0	0	0.0177
11	110	0	0	0	0	0	0.00929	0.008221	0	0	0	0
12	120	0.005405	0	0	0	0	0	0.005799	0	0	0	0
13	130	0	0	0	0	0	0	0.005371	0	0	0	0
14	140	0	0	0	0	0	0	0.005042	0	0	0	0
15	150	0.104516	0	0.115617	0	0	0	0.005117	0	0	0	0
16	160	0.224121	0	0.682833	0.00462	0	0	0.005919	0	0	0	0
17	170	0.221061	0	0.954082	0.005892	0	0	0.00717	0	0	0	0
18	180	0.233559	0	1.048662	0.020693	0.01045	0	0.006459	0.004019	0.005315	0	0
19	190	0.19987	0	1.116013	0.060146	0.034574	0	0.007717	0.024977	0.00916	0.017222	0
20	200	0.161718	0	1.131002	0.174929	0.114618	0	0.009636	0.153668	0.012719	0.245569	0.048644
21	210	0.131831	0	1.075951	0.223618	0.163601	0	0.010561	0.394979	0.012462	0.8213	0.231806
22	220	0.123203	0	1.003389	0.180899	0.138495	0	0.01015	0.499232	0.014117	1.117489	0.453861
23	230	0.168843	0.065264	1.00418	0.163845	0.120315	0	0.009734	0.58554	0.00999	1.091953	0.493234
24	240	0.097127	0.282566	1.06914	0.17408	0.122311	0.02487	0.02785	0.772965	0.014776	1.312766	0.794658

N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-2

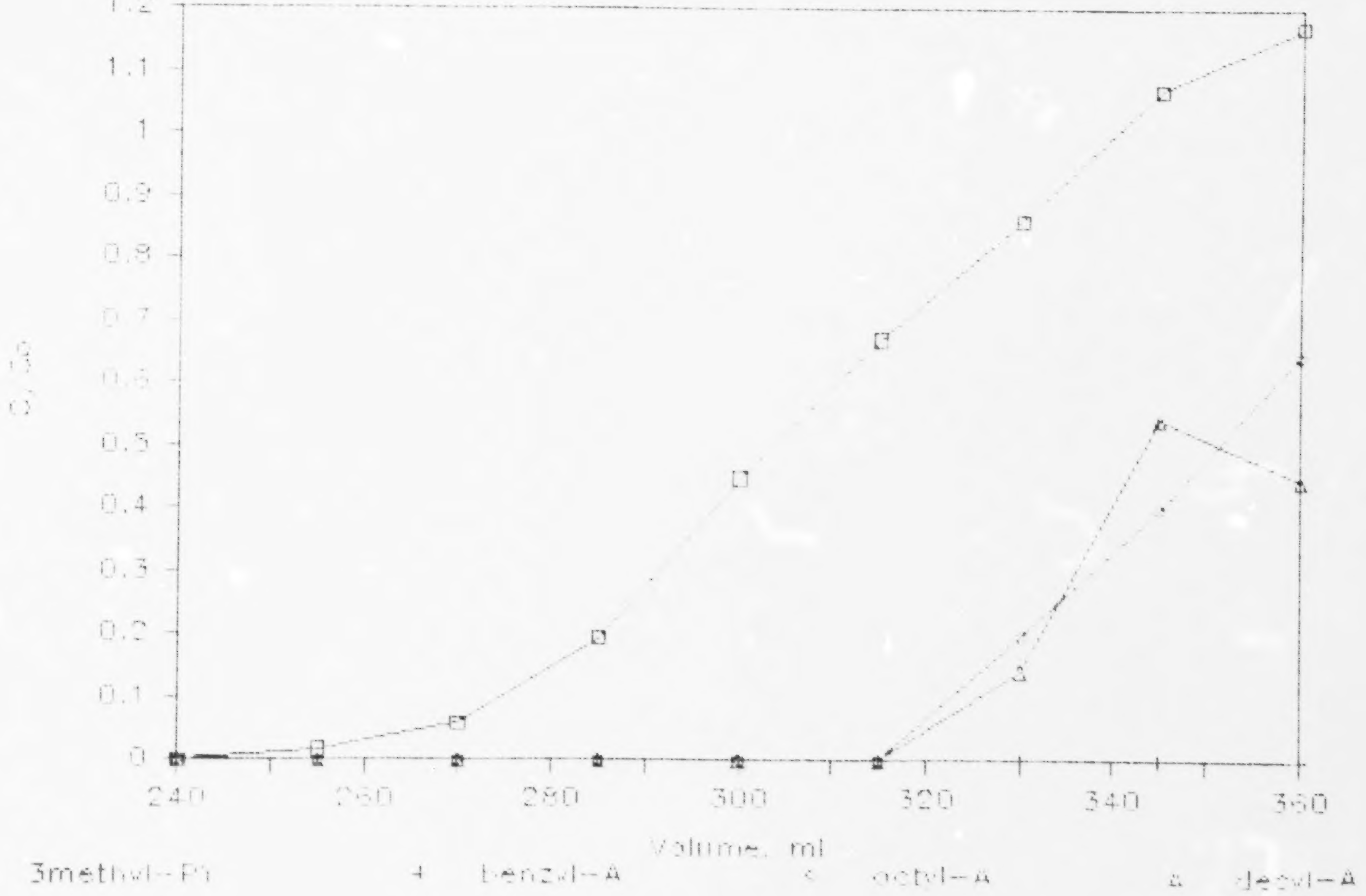


N-COMPOUNDS BREAKTHROUGH CURVES



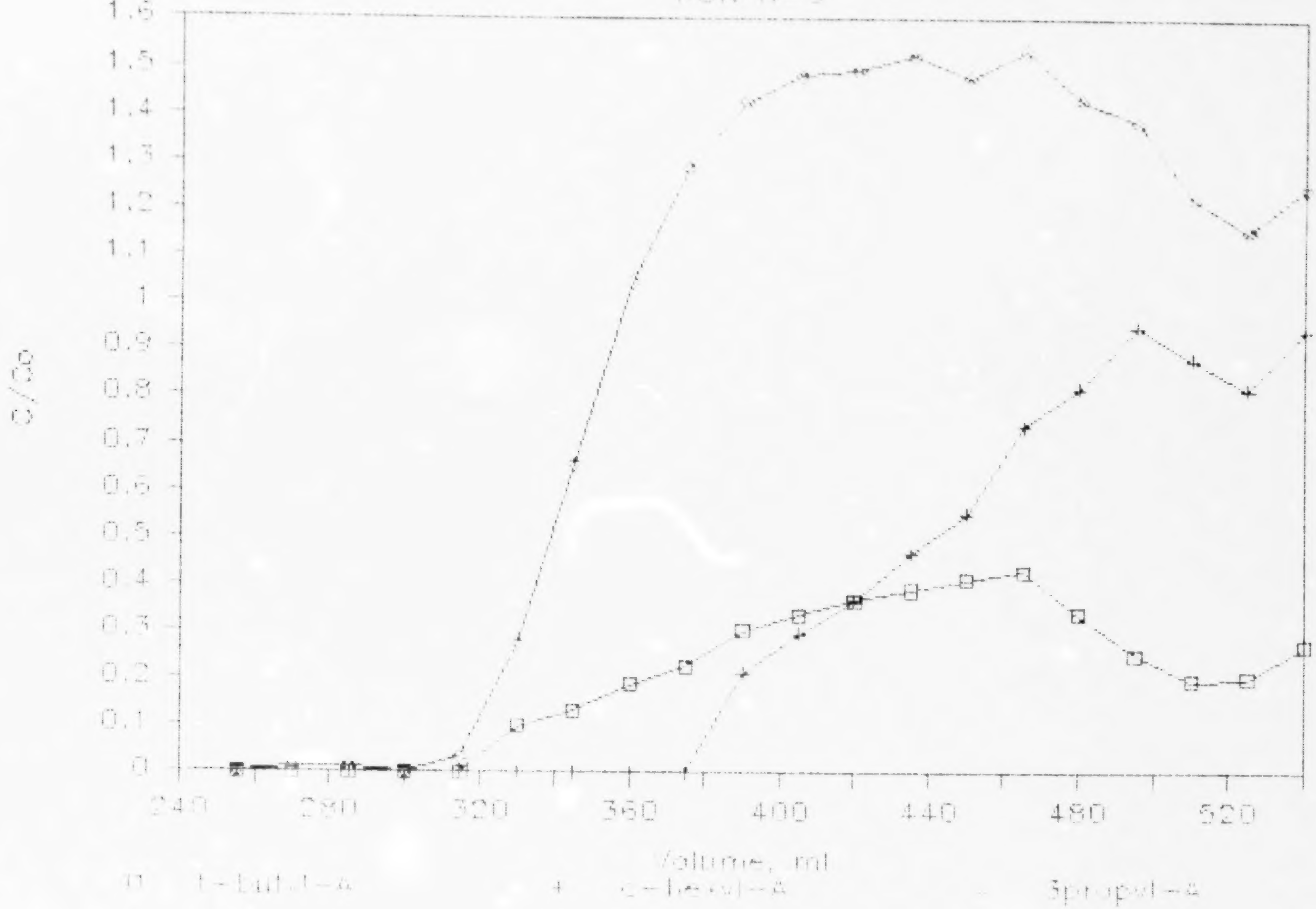
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-2



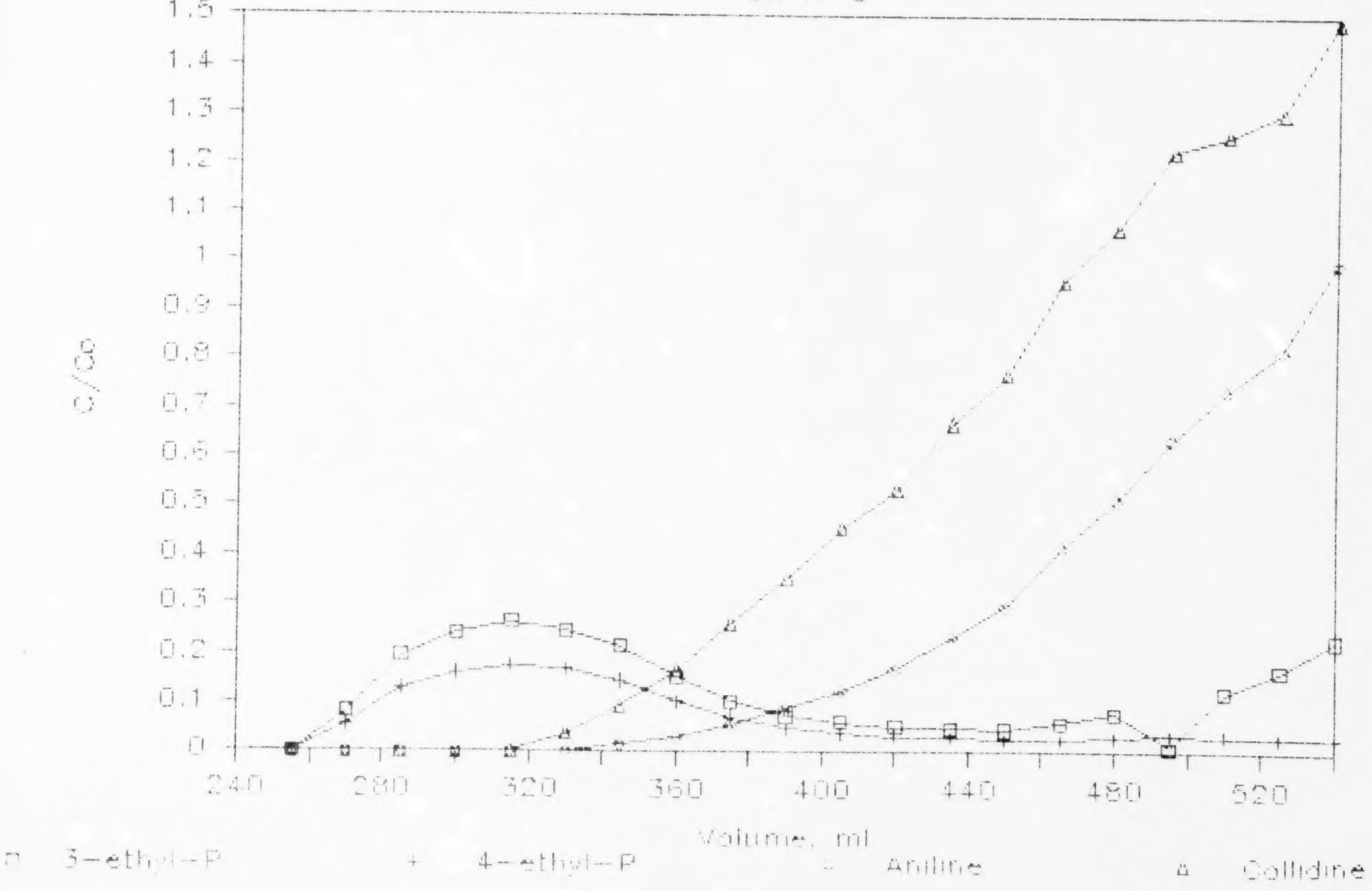
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-5



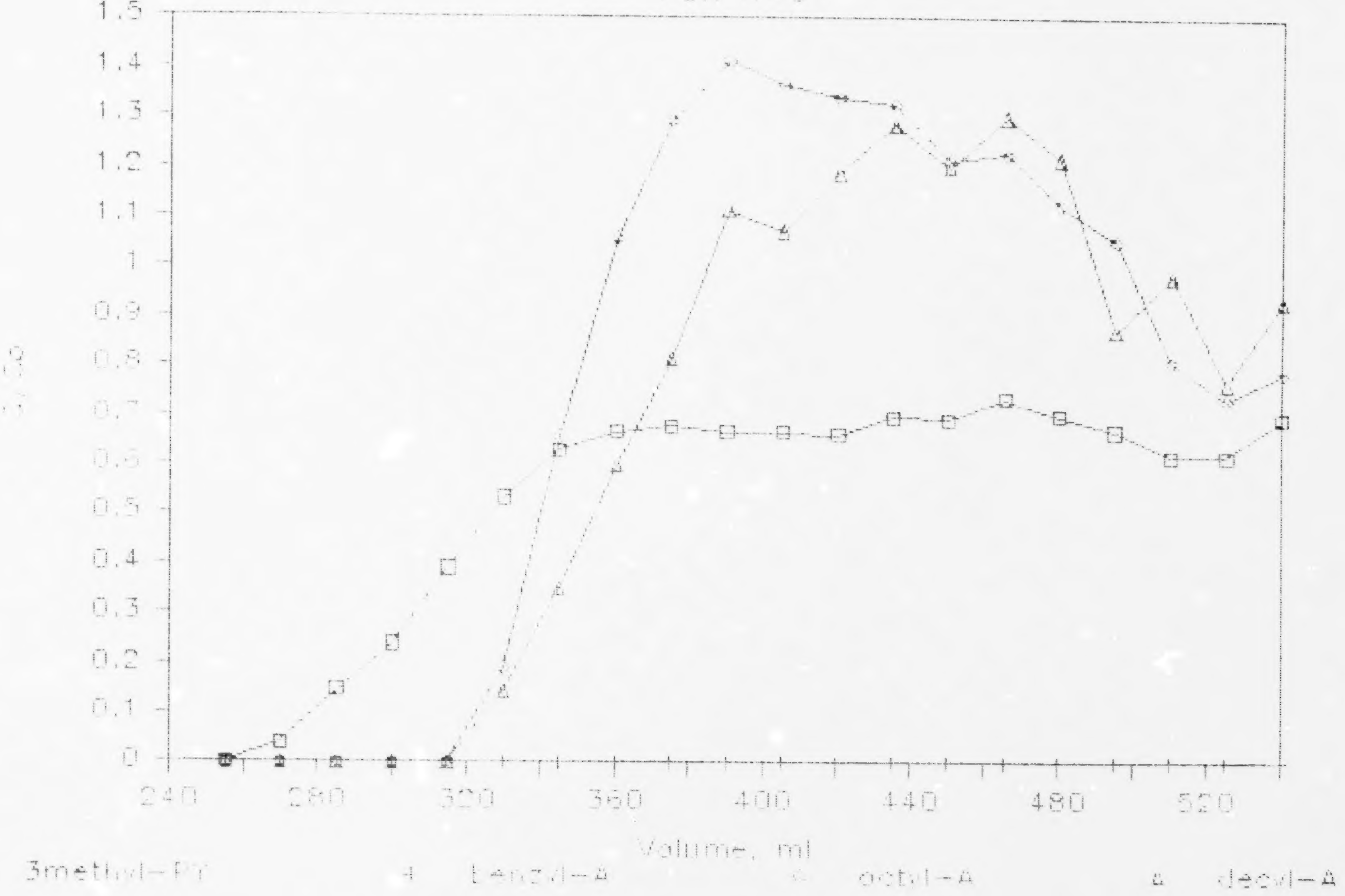
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N—5



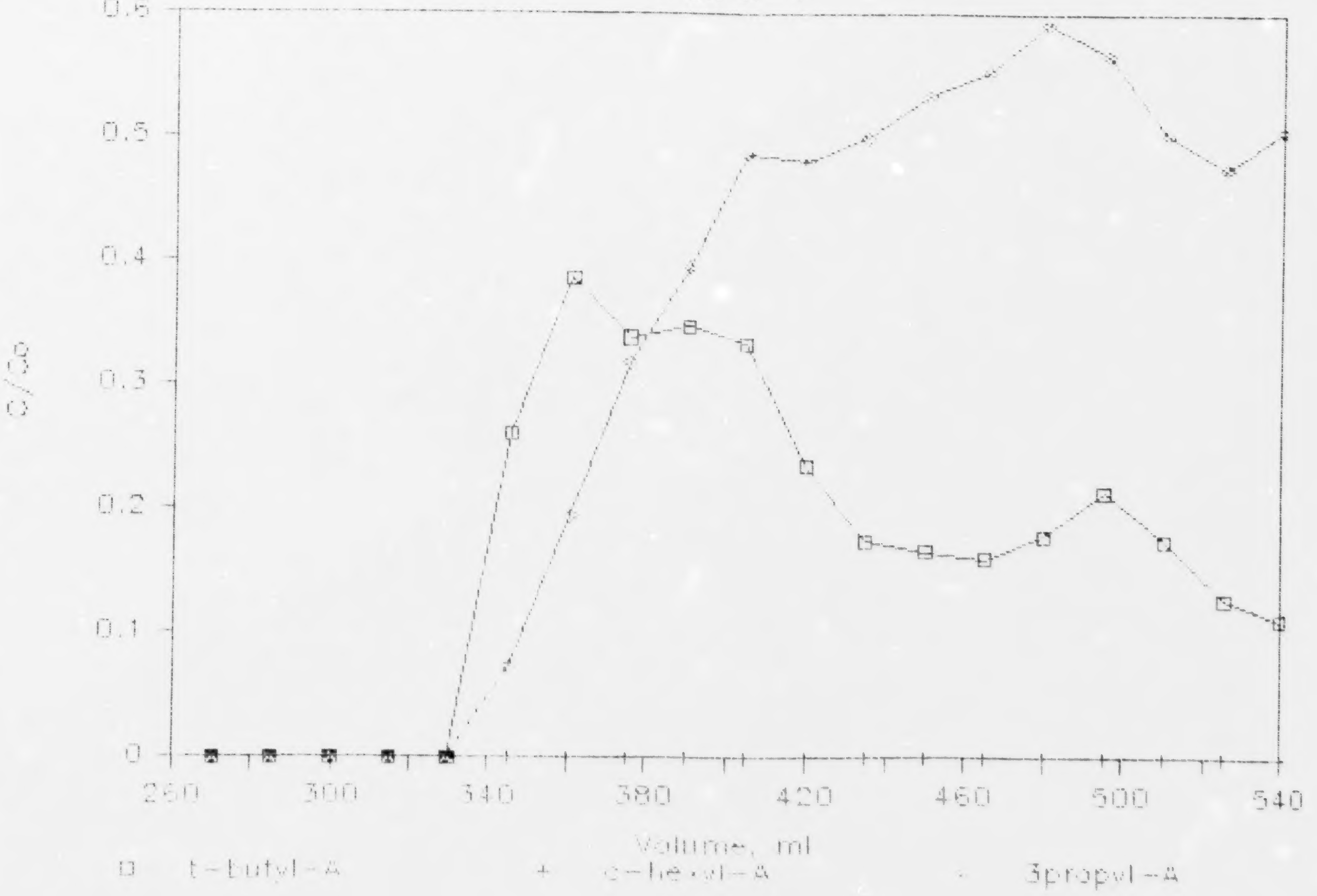
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N-5



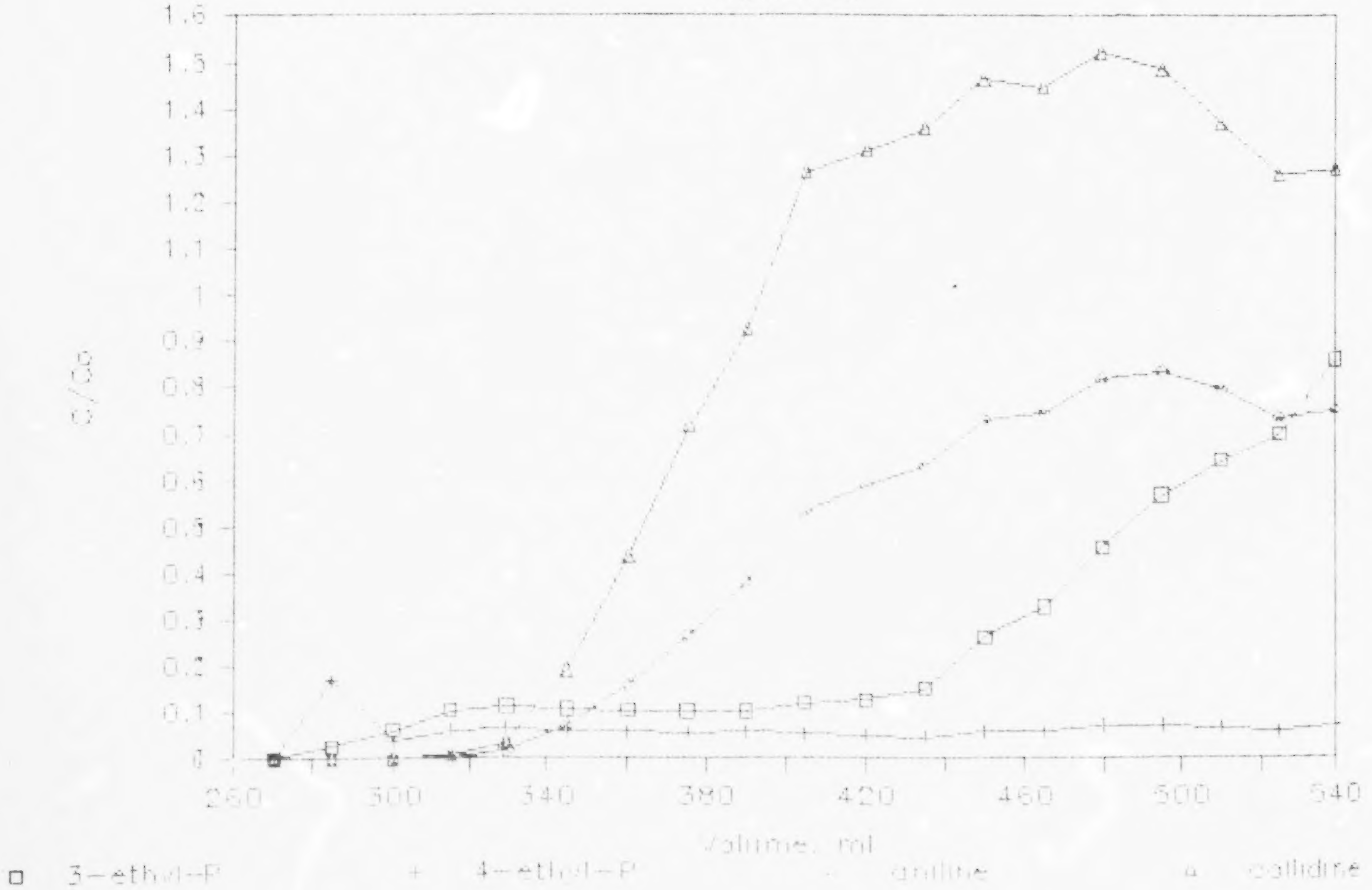
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-4



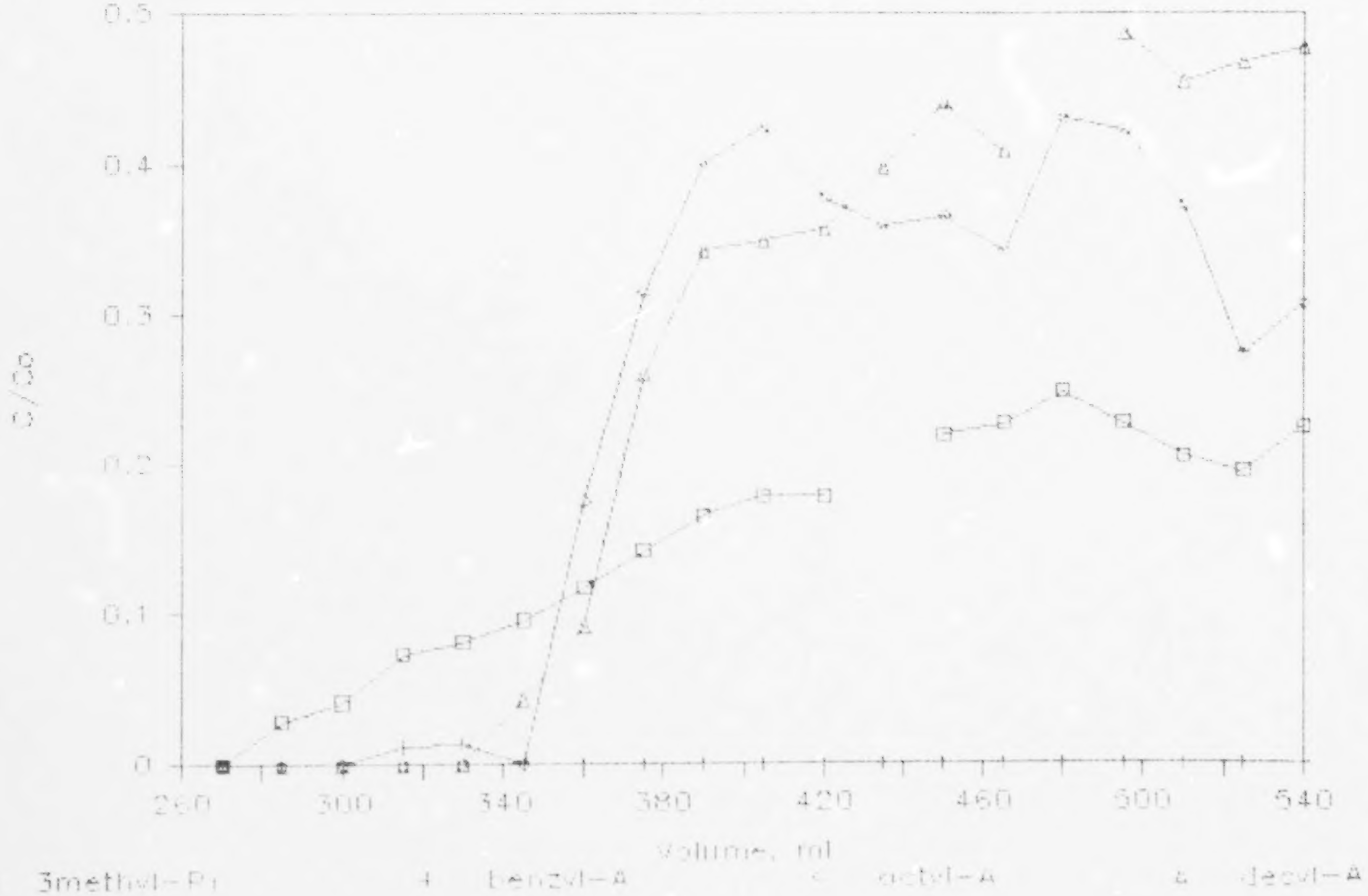
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N—4



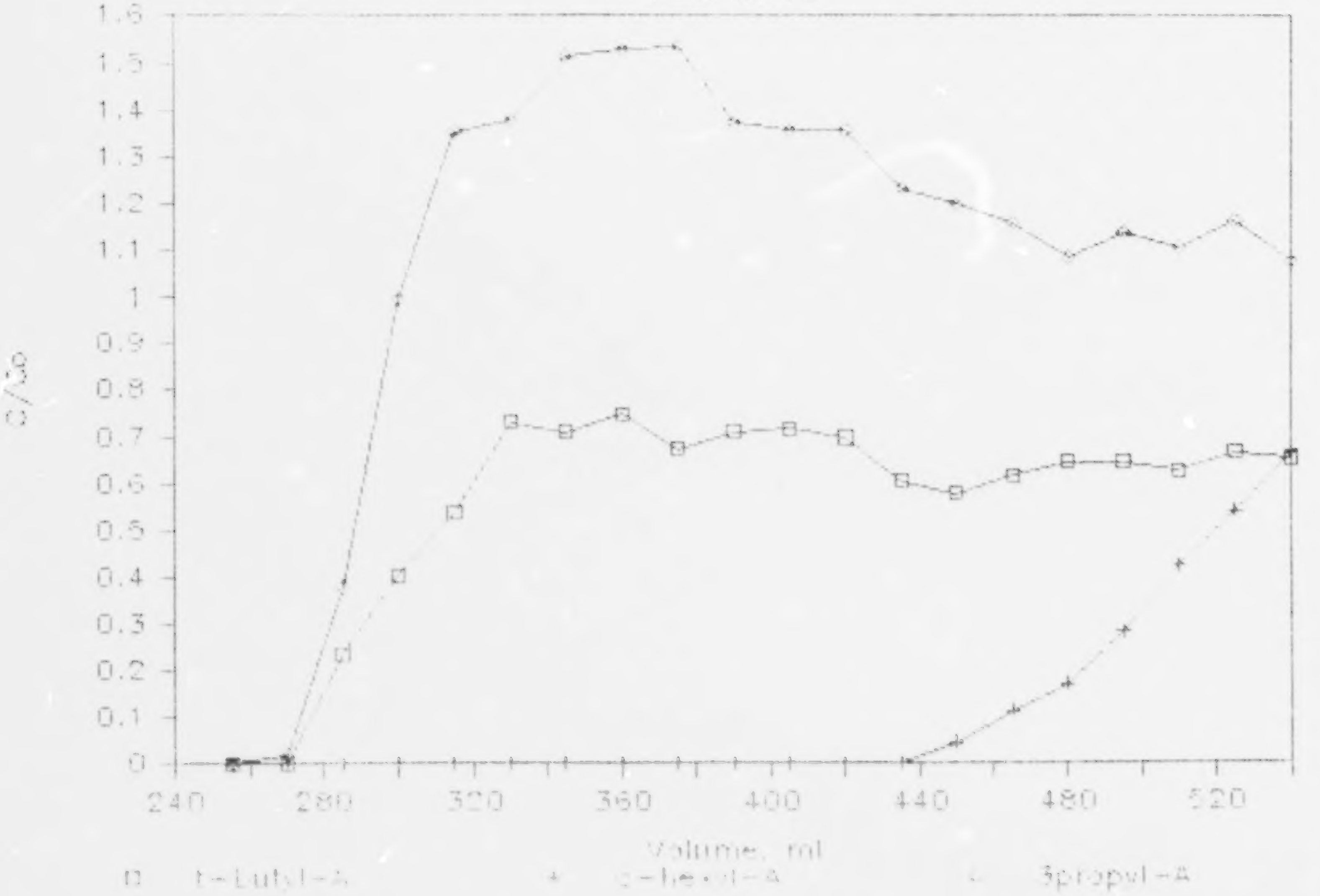
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N-4



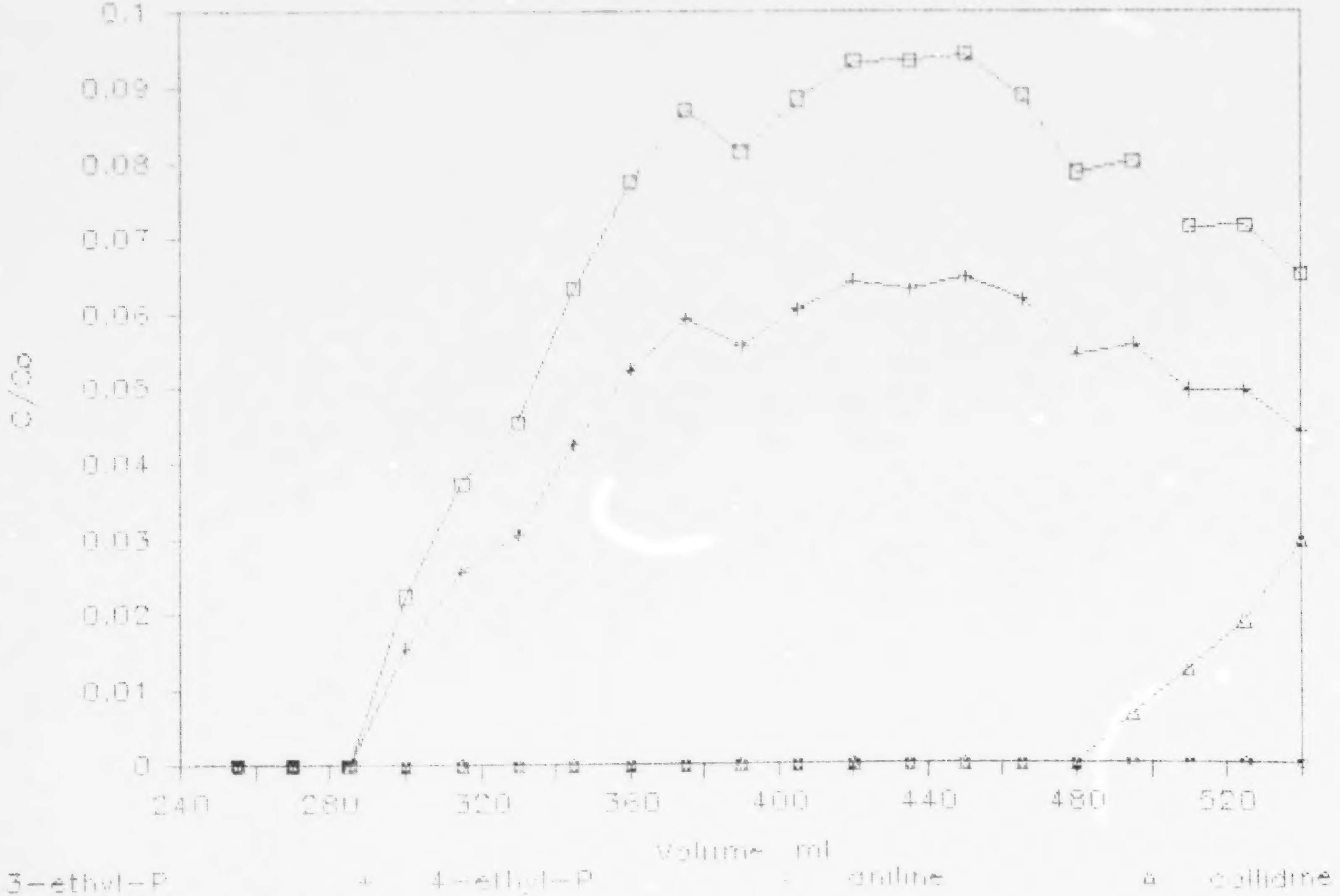
N—COMPOUNDS BREAKTHROUGH CURVES

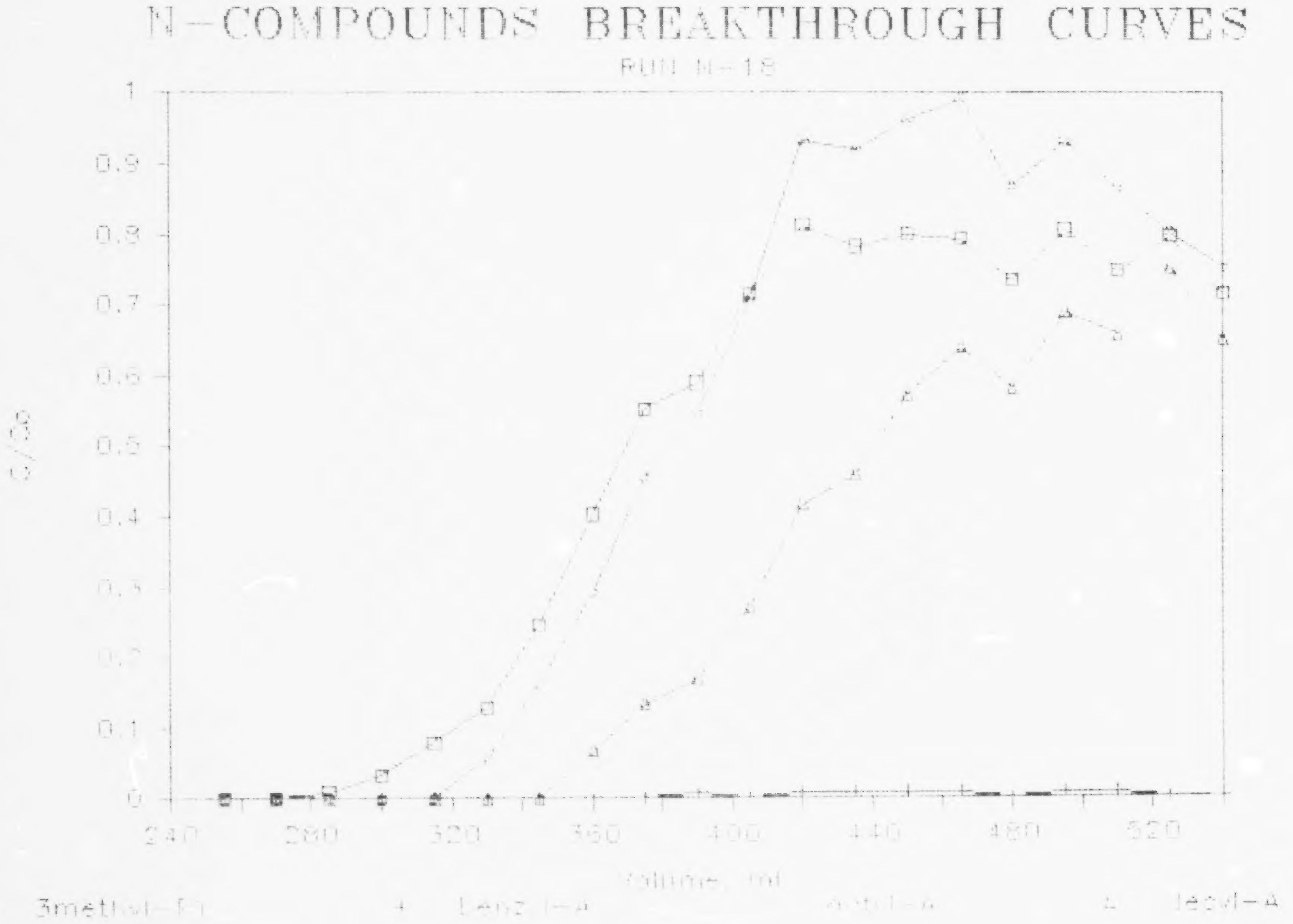
RUN N-18



N–COMPOUNDS BREAKTHROUGH CURVES

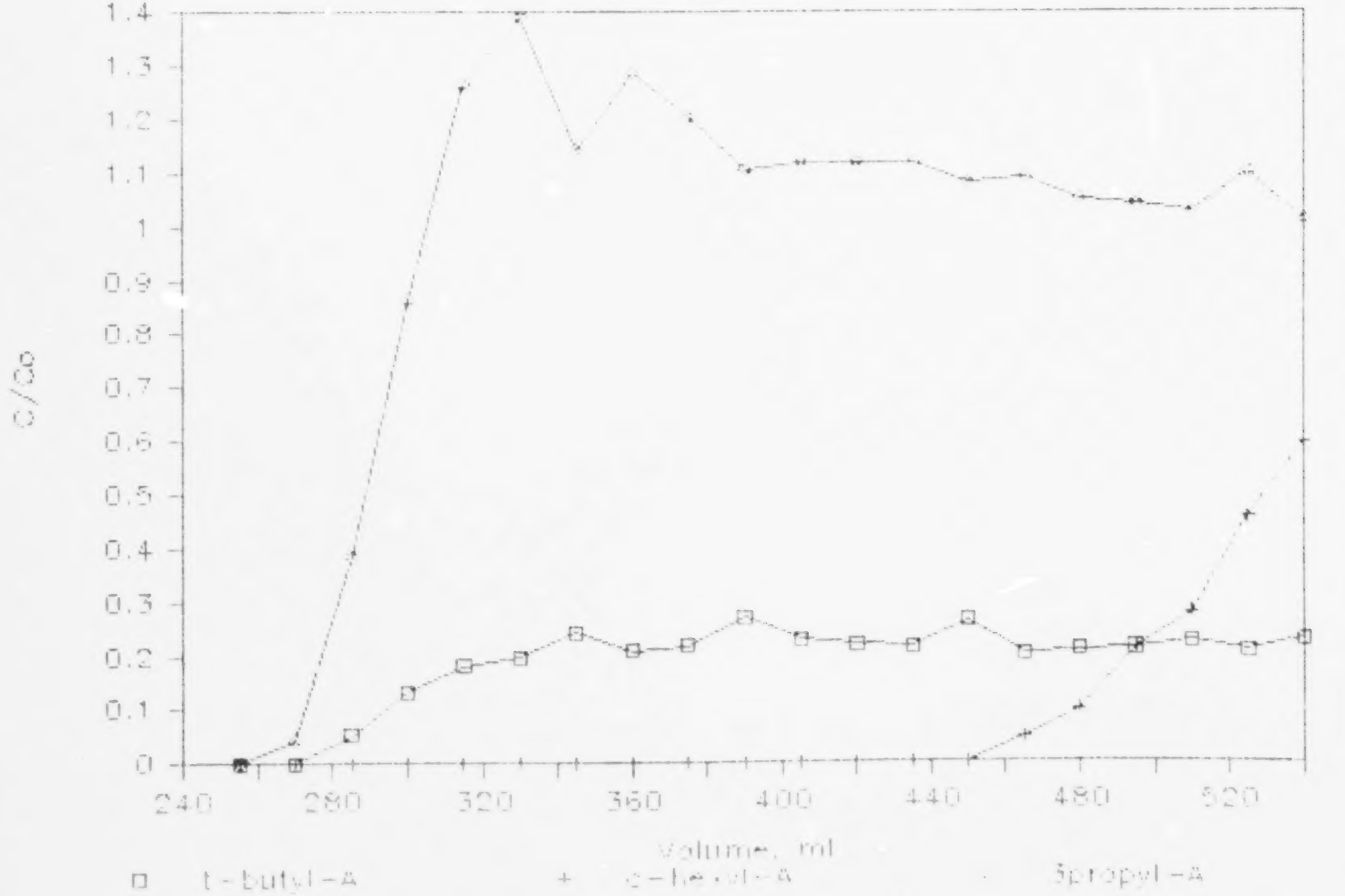
RUN N–18

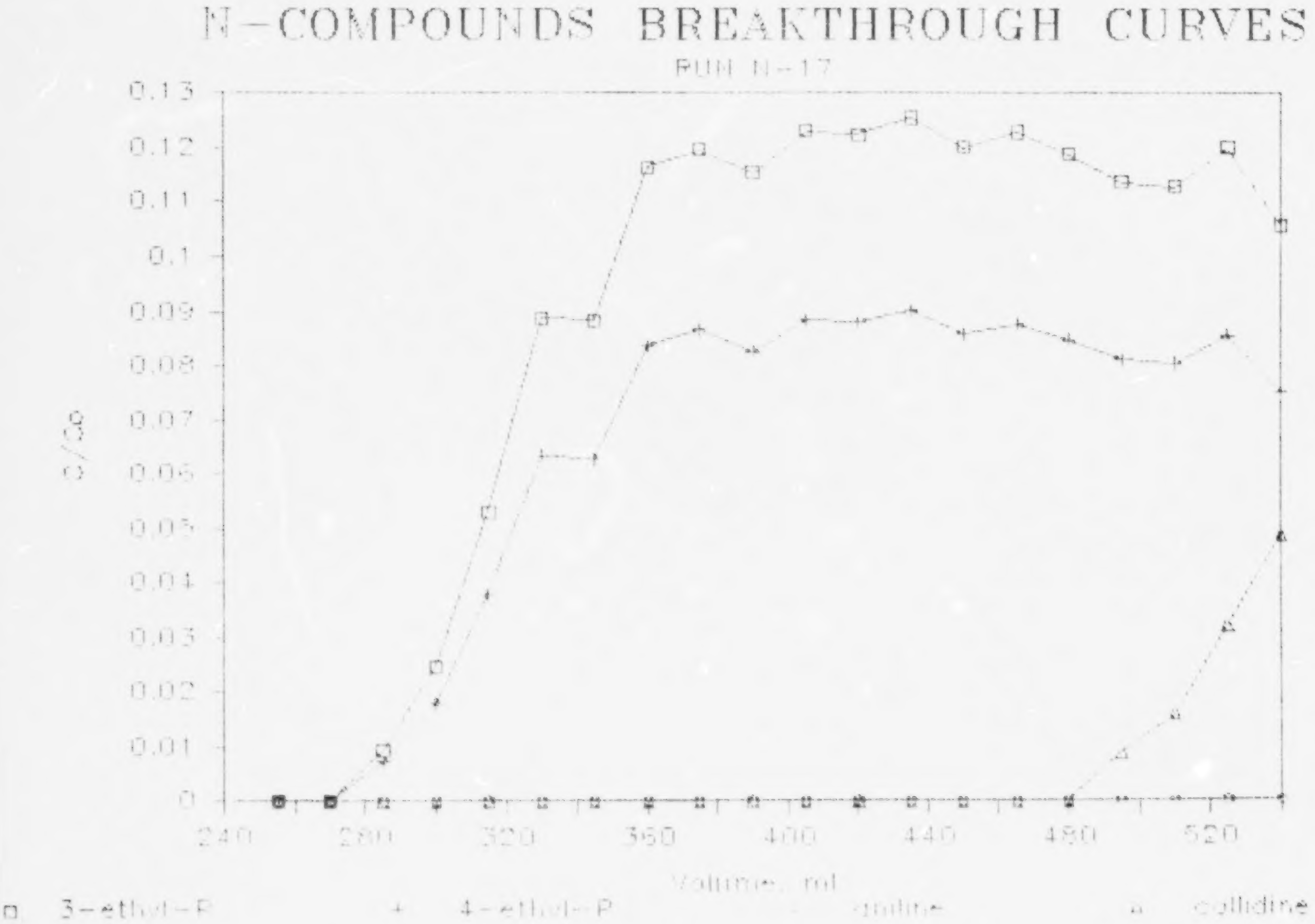



N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-18
C/Co
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
240
280
320
360
400
440
480
520
Volume, ml
3methyl-P
Benzyl-A
octyl-A
decyl-A

N-COMPOUNDS BREAKTHROUGH CURVES

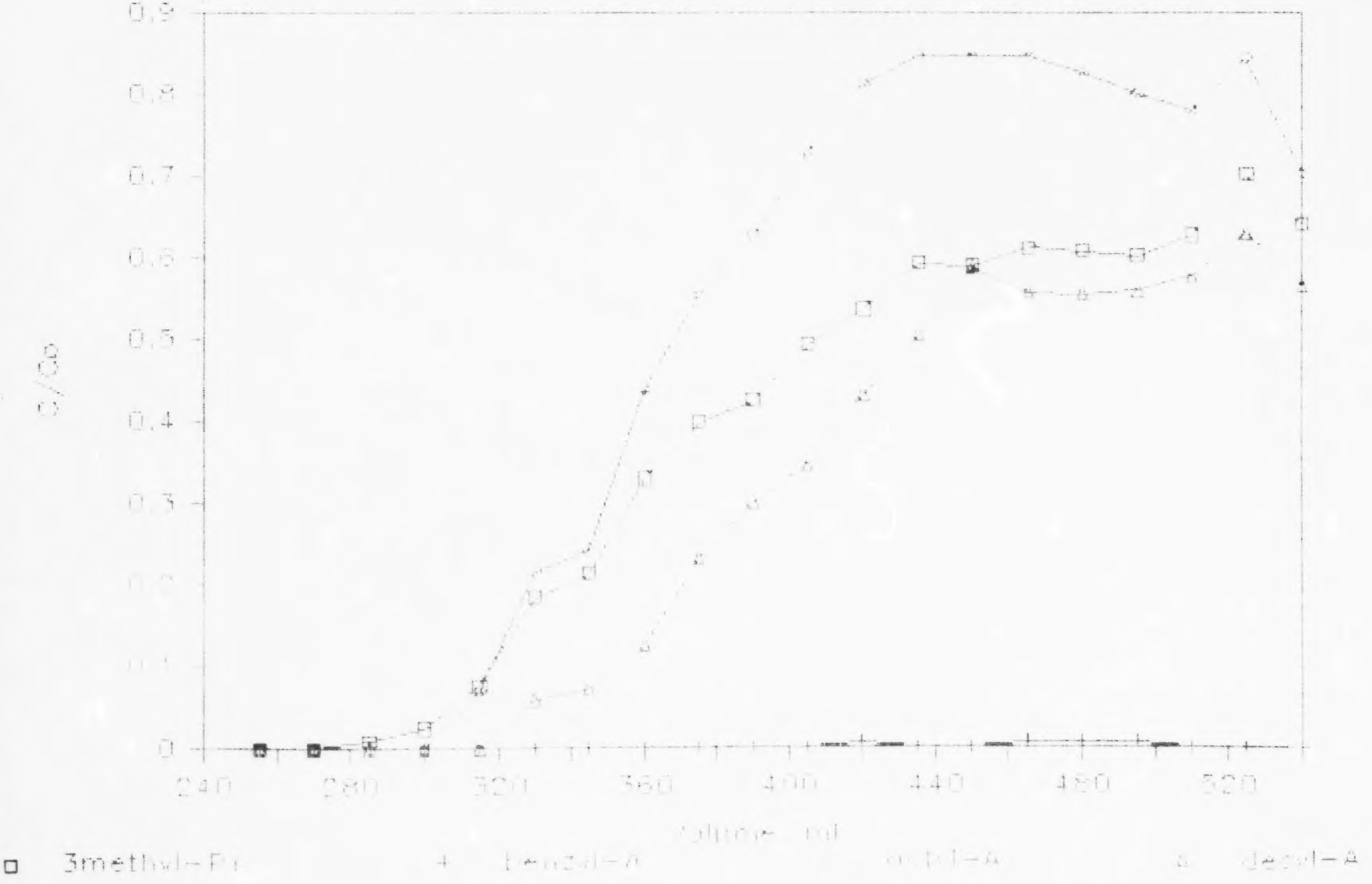
RUN N-17




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-17
C/Co
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
240
280
320
360
400
440
480
520
Volume, ml
□ 3-ethyl-P
+ 4-ethyl-P
aniline
△ collidine

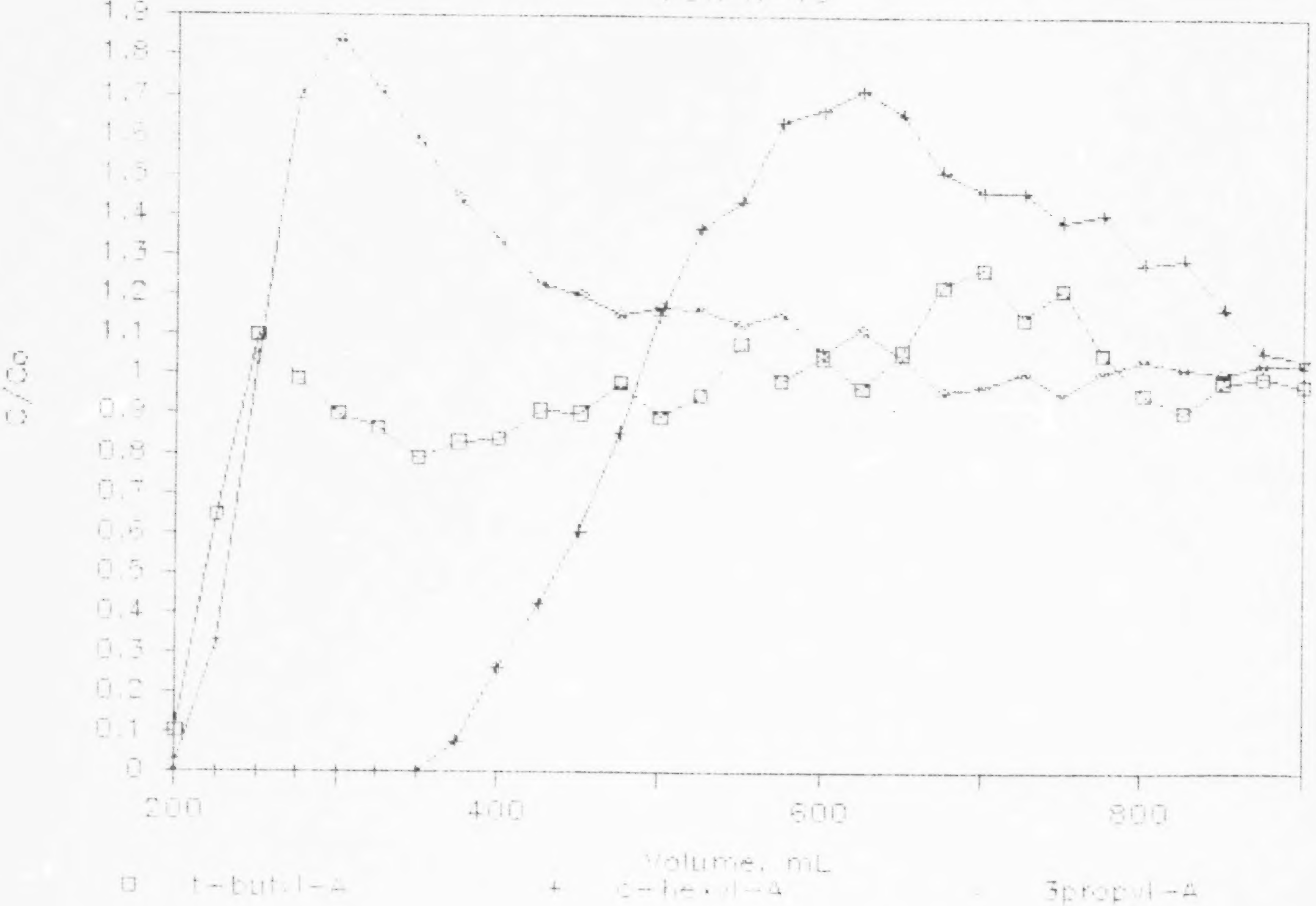
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–17



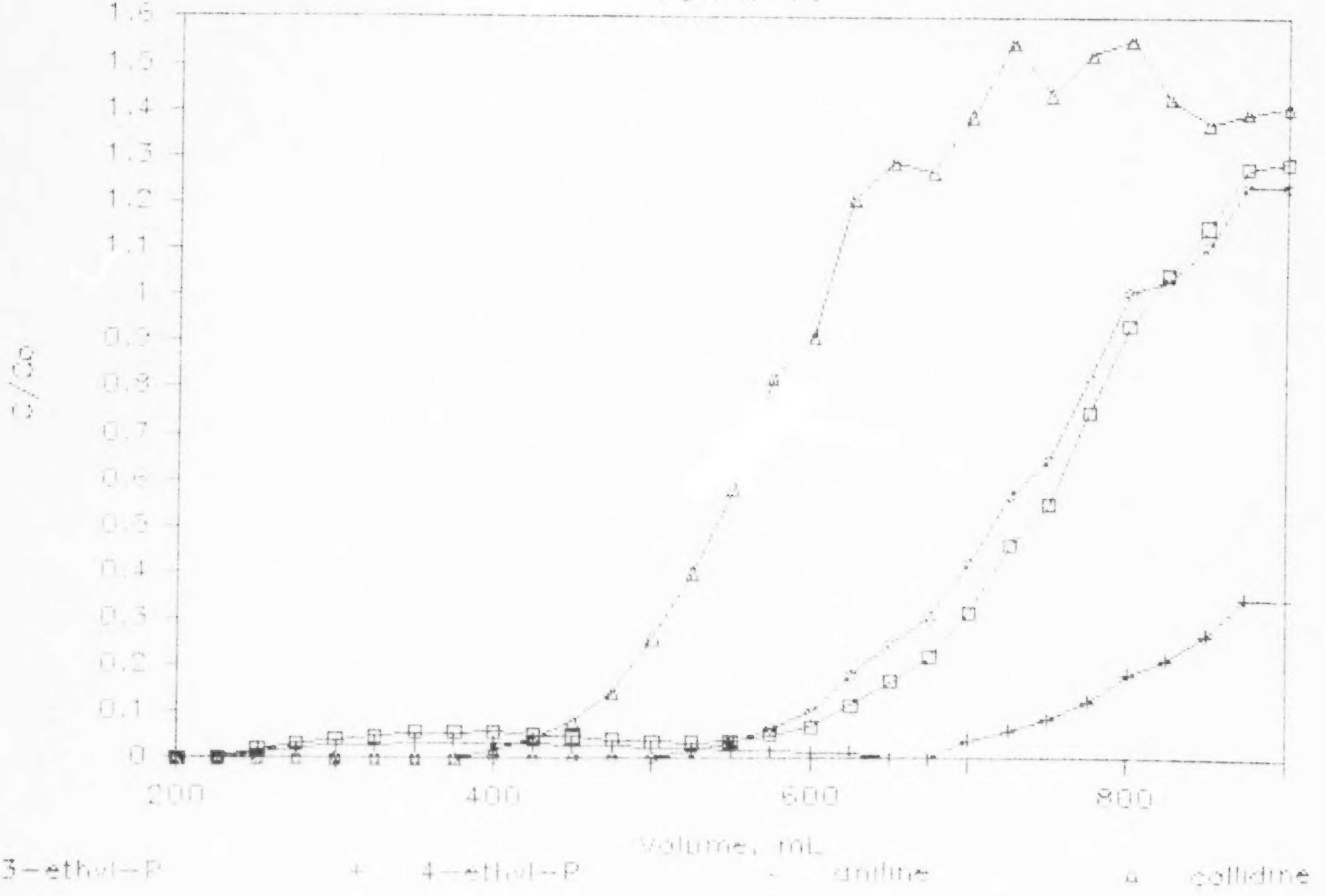
N–COMPOUNDS BREAKTHROUGH CURVES

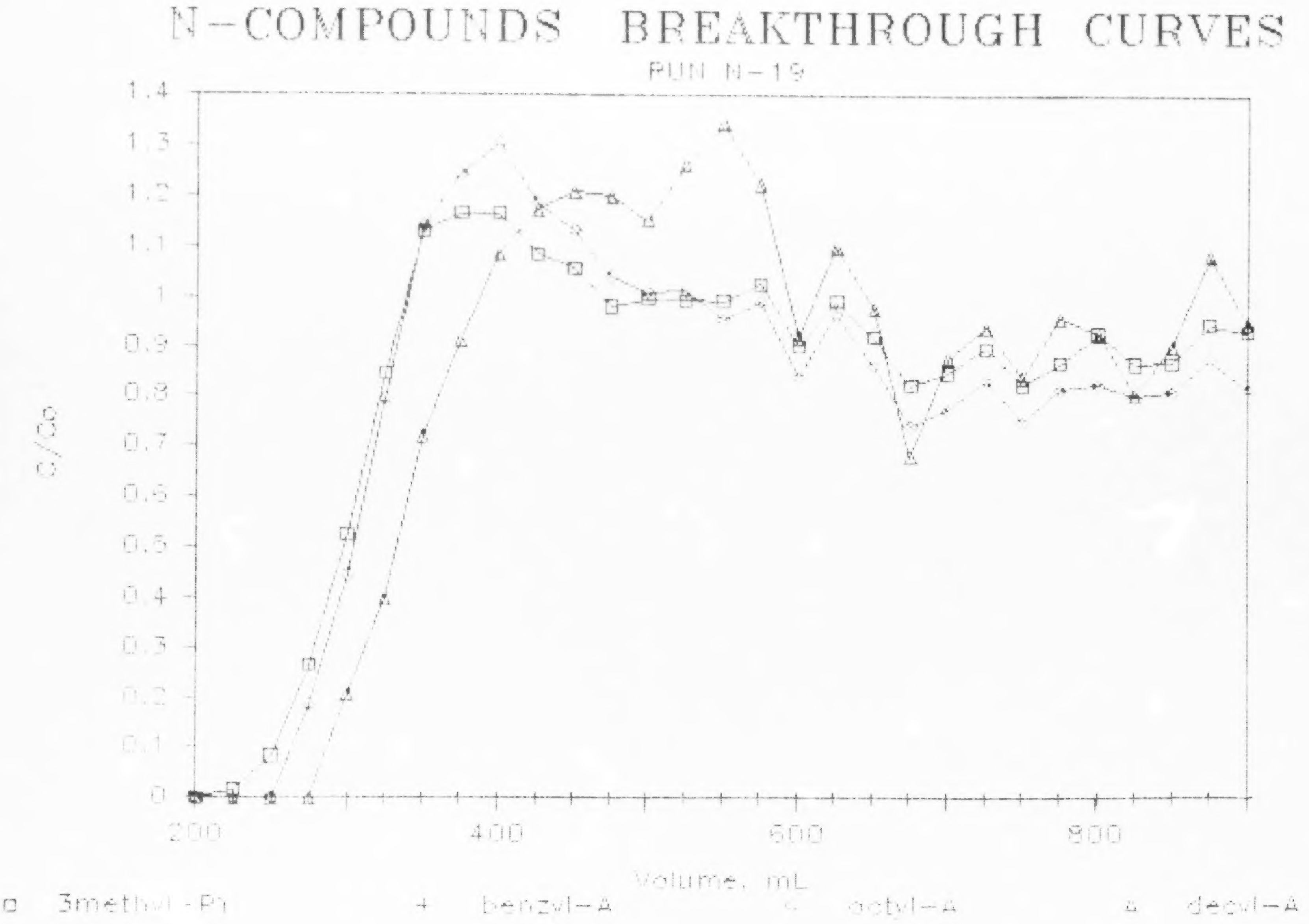
RUN N–19



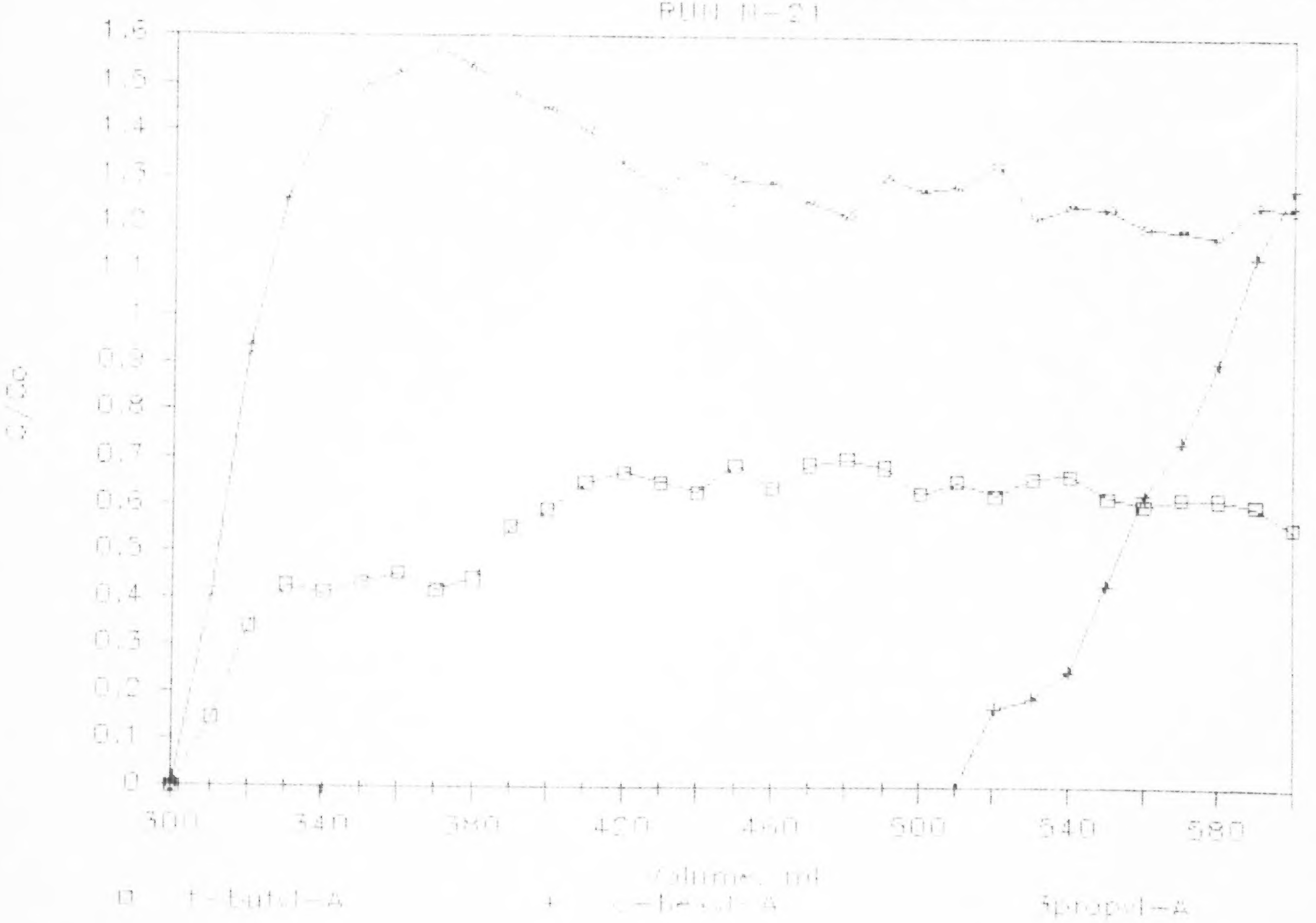
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N-19



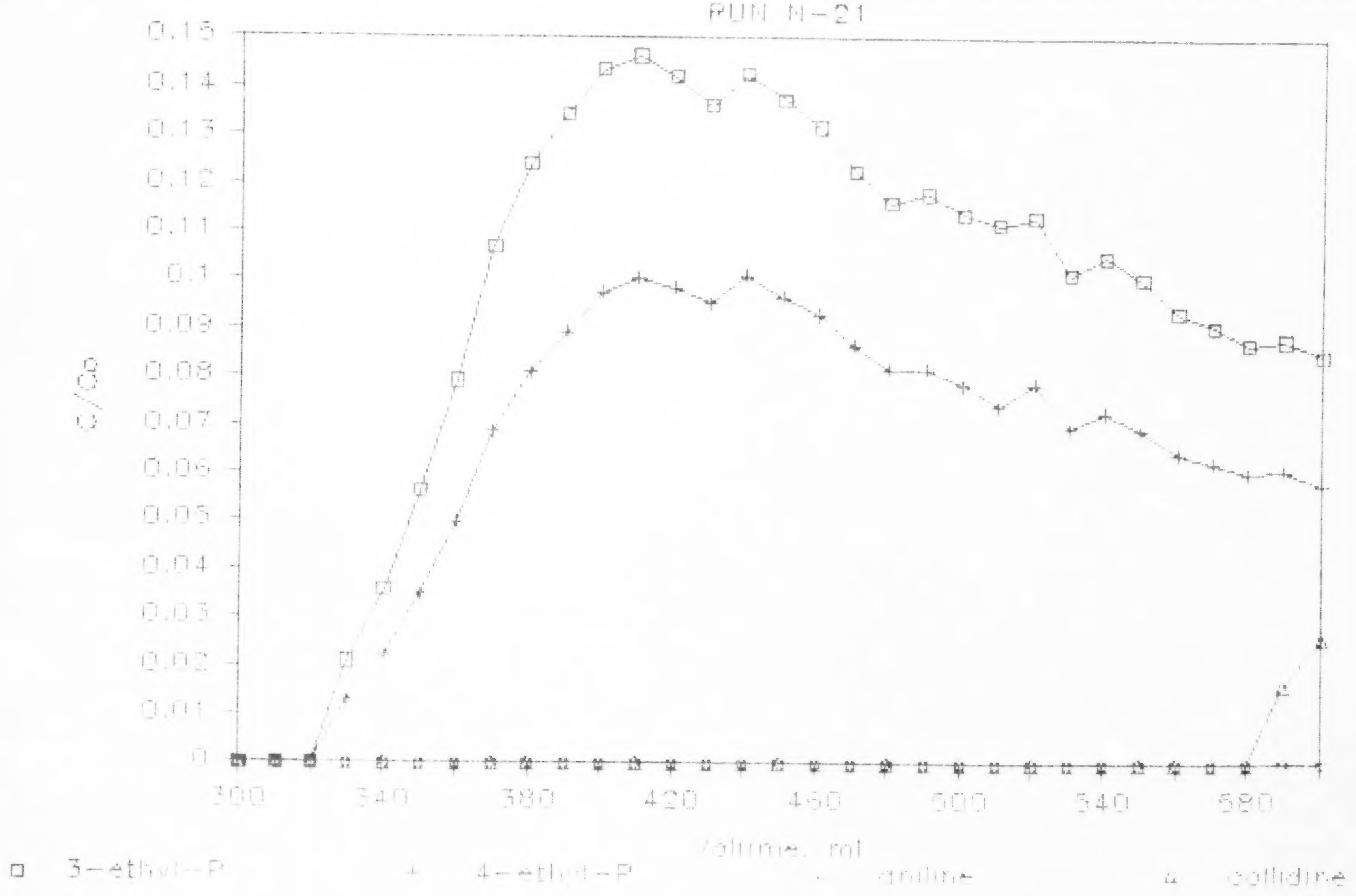

N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-19
C/Co
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
200
400
600
800
Volume, mL
□ 3methyl-Py
+ benzyl-A
◇ octyl-A
△ decyl-A

N-COMPOUNDS BREAKTHROUGH CURVES



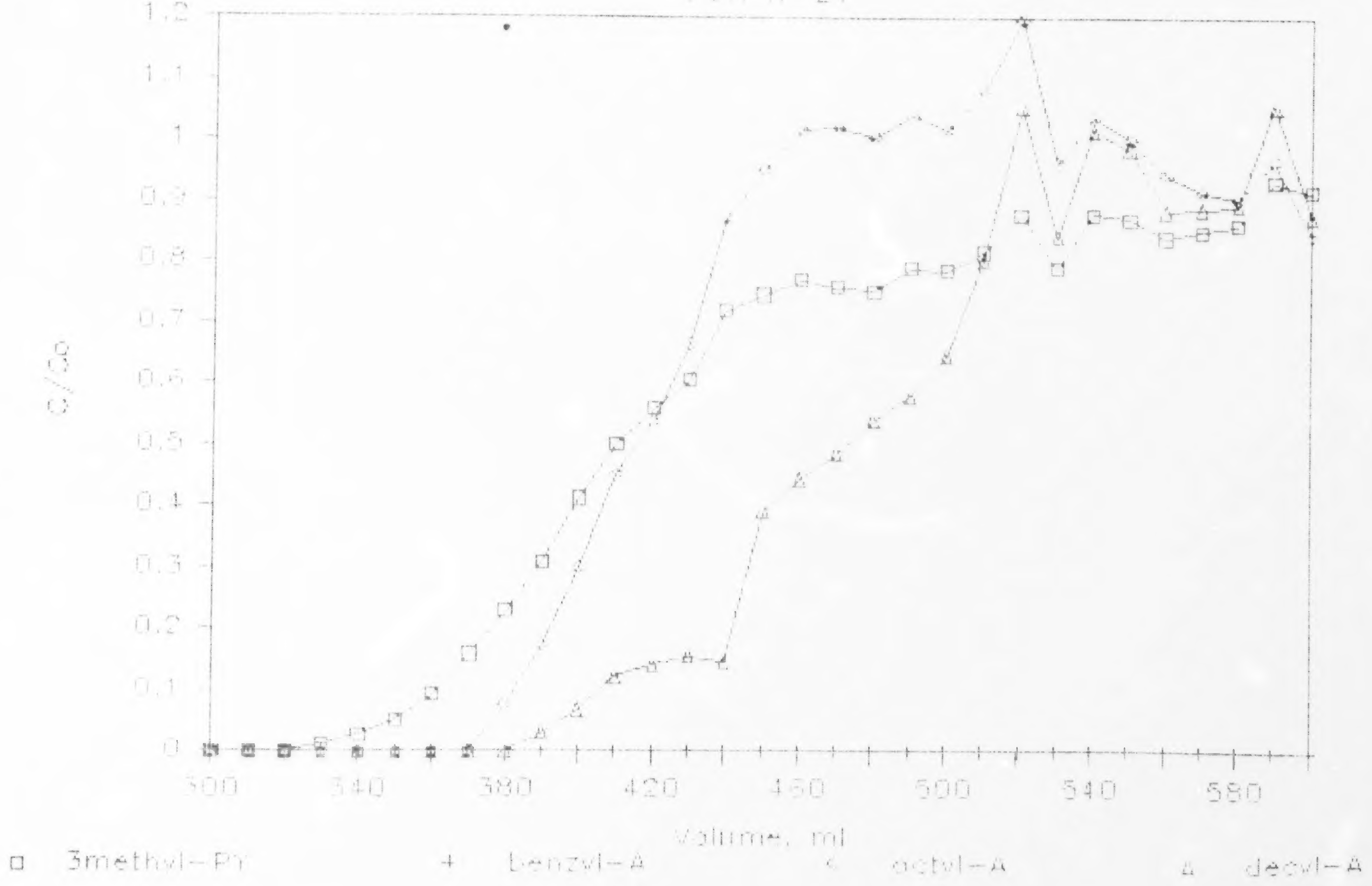
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–21

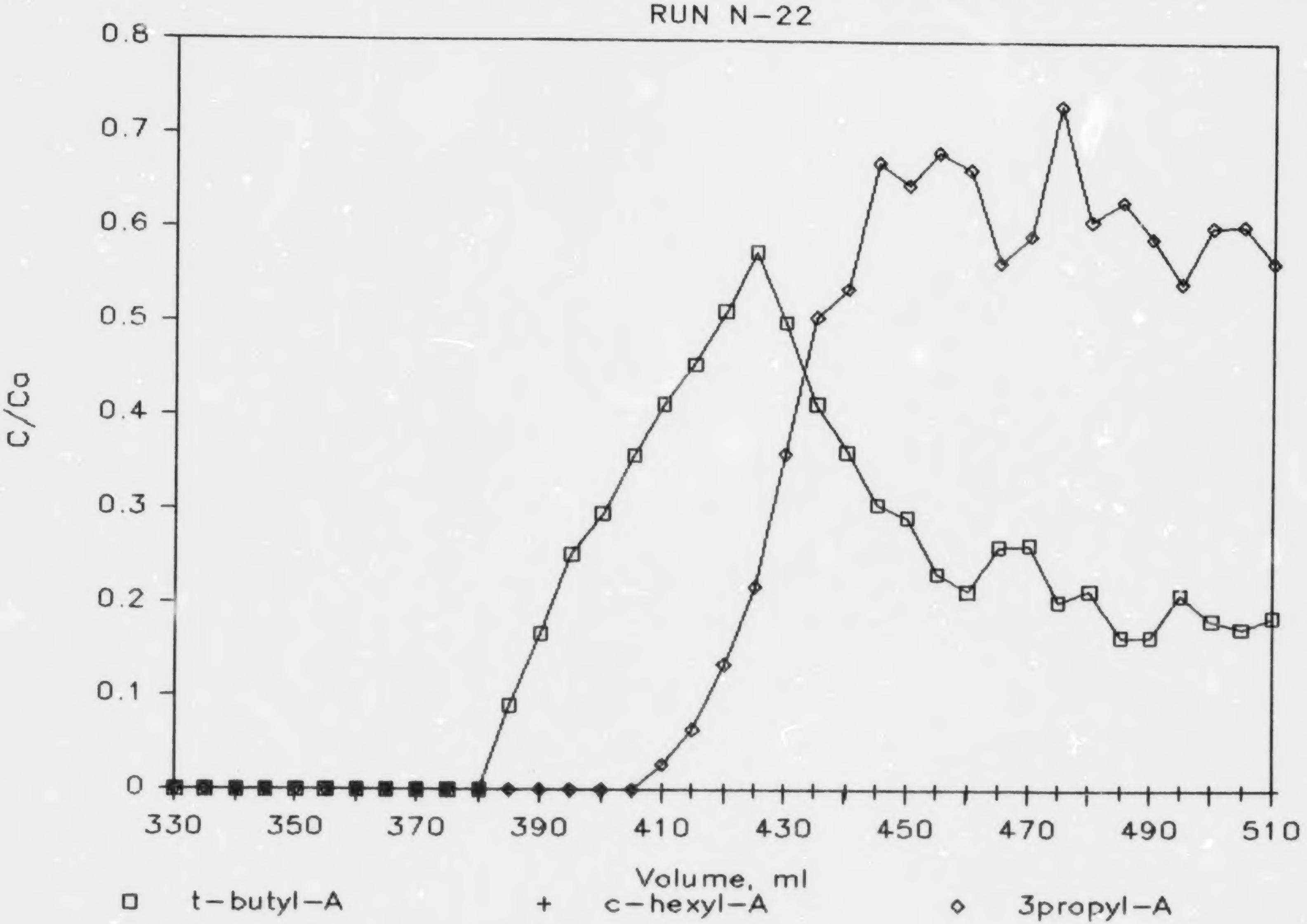


N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–21

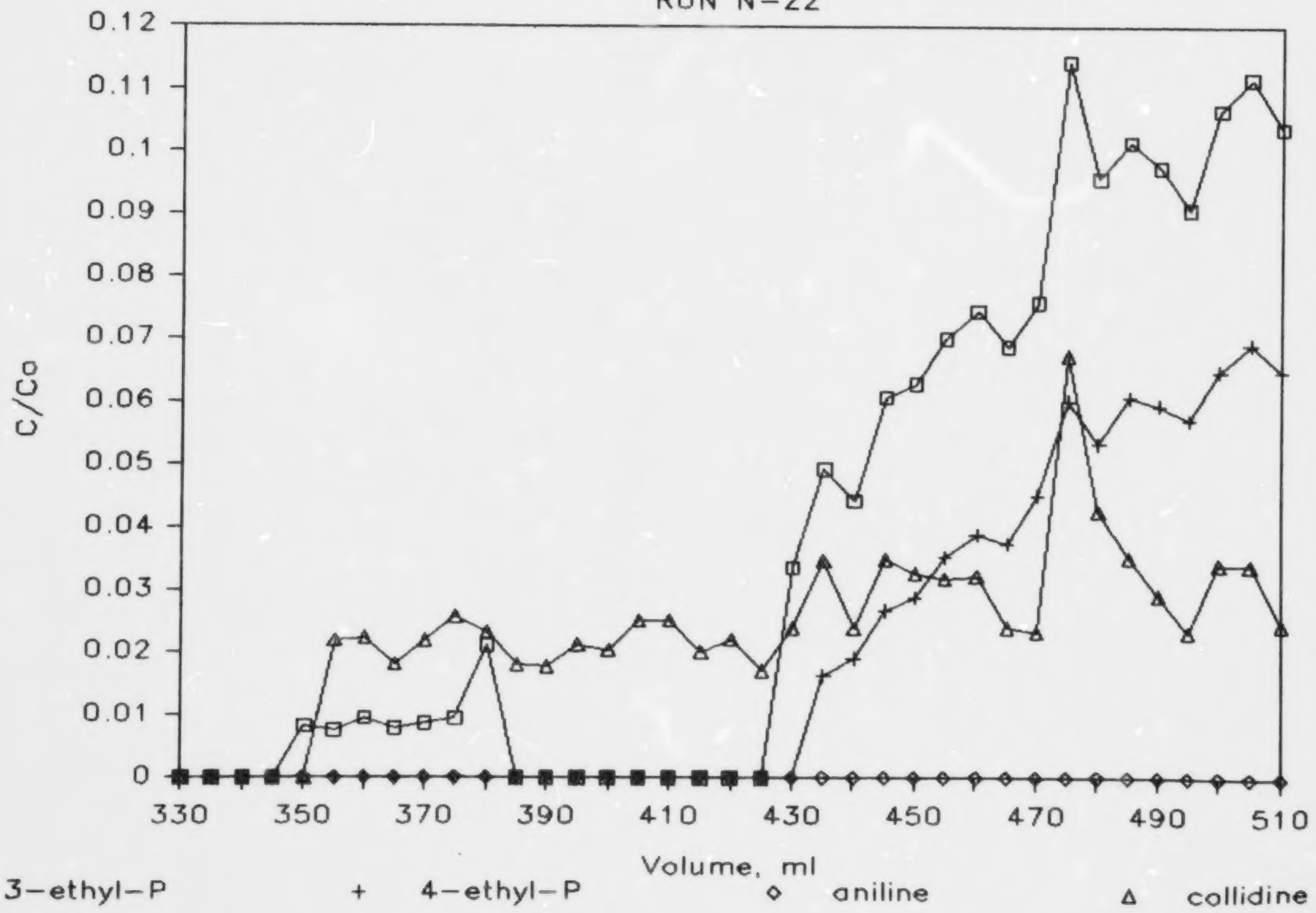


N-COMPOUNDS BREAKTHROUGH CURVES

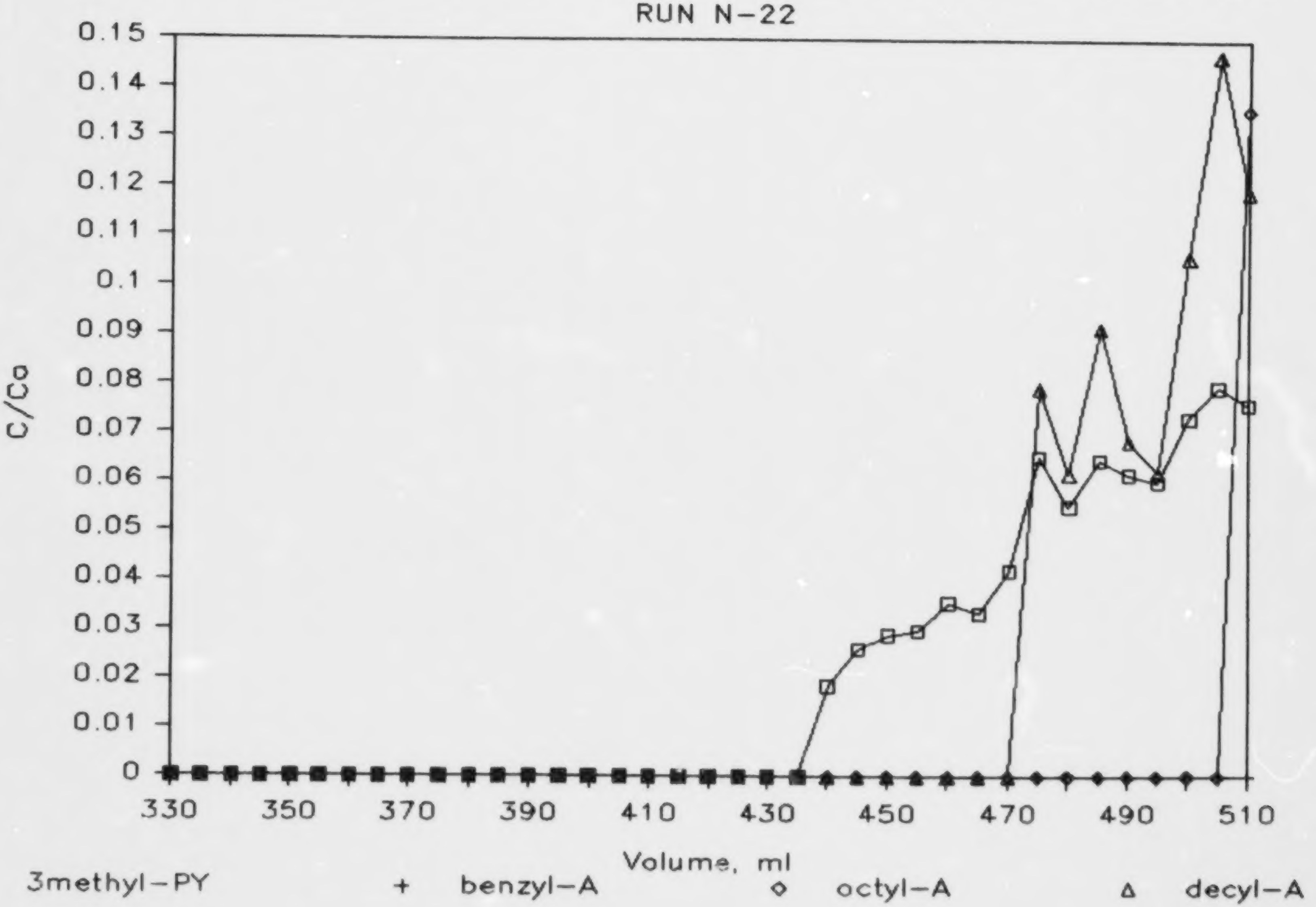


N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–22

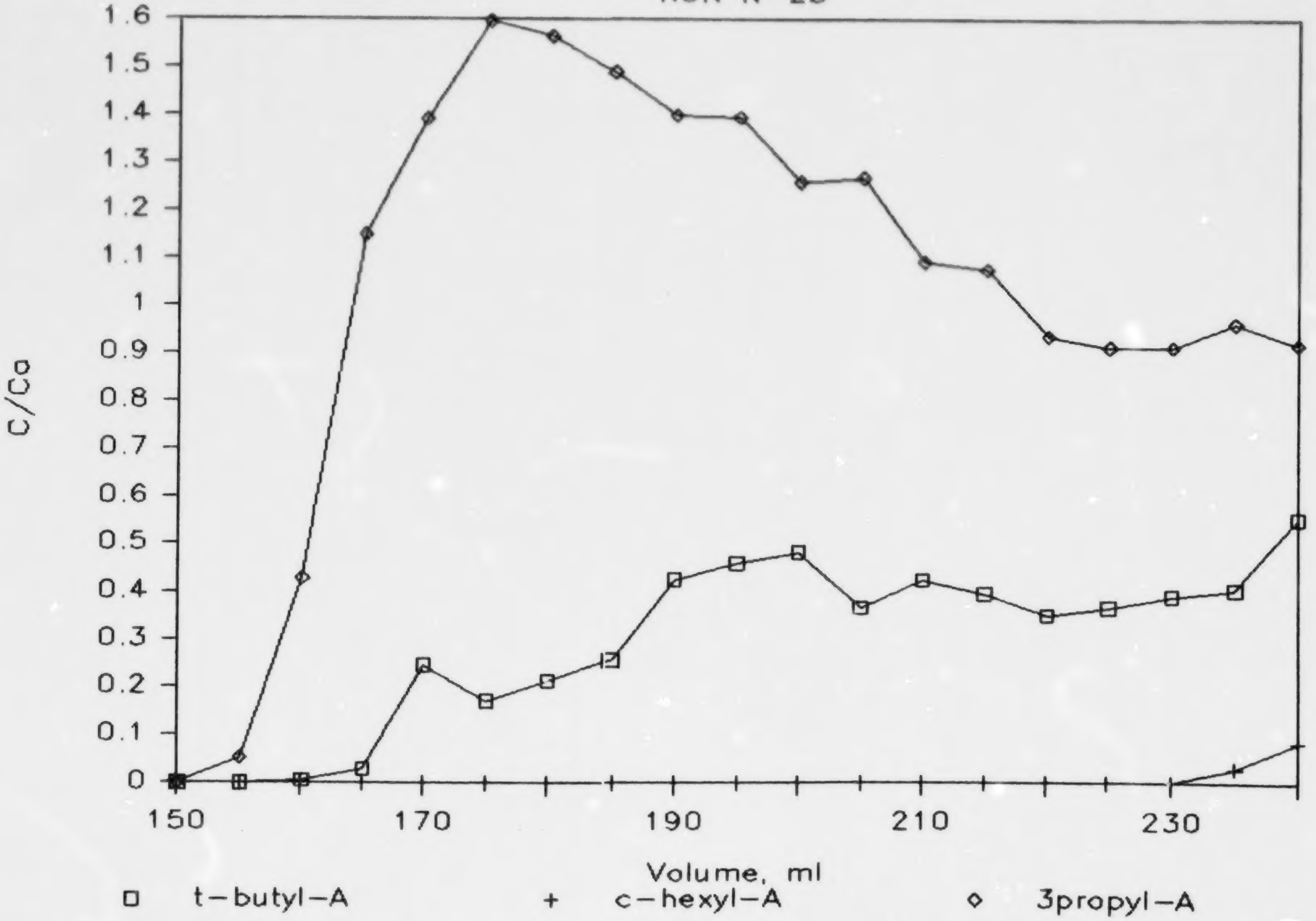


N-COMPOUNDS BREAKTHROUGH CURVES



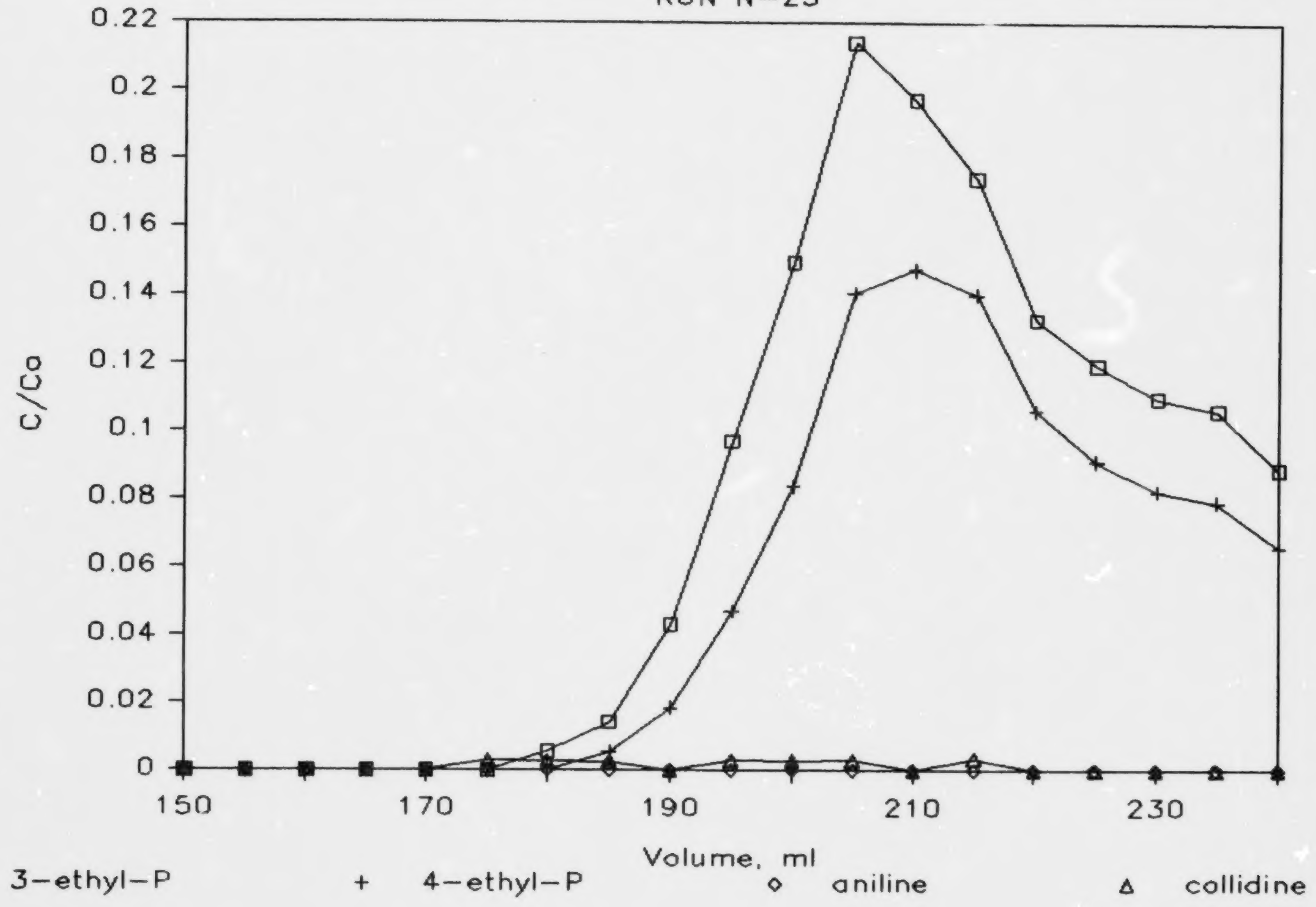
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-23



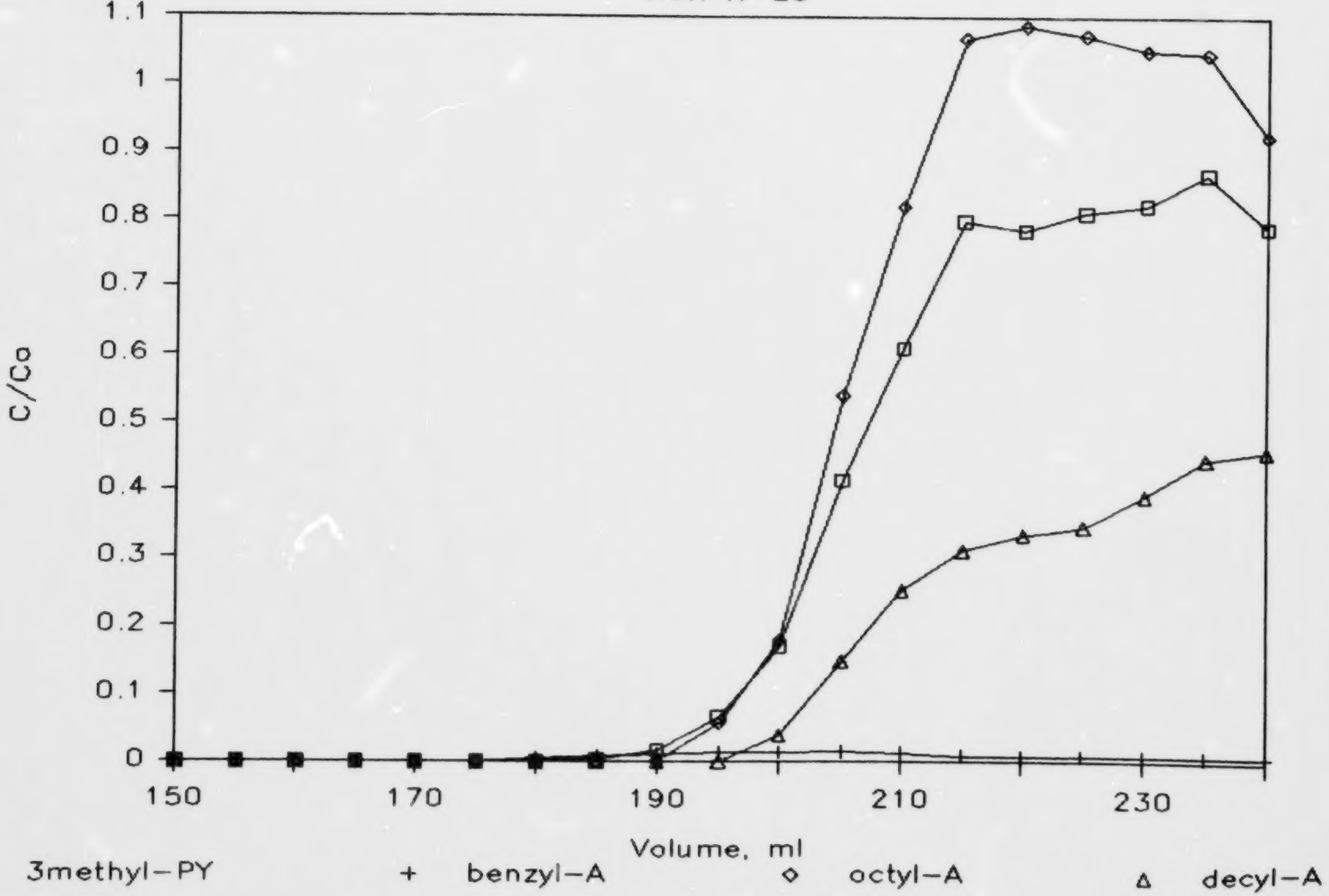
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-23



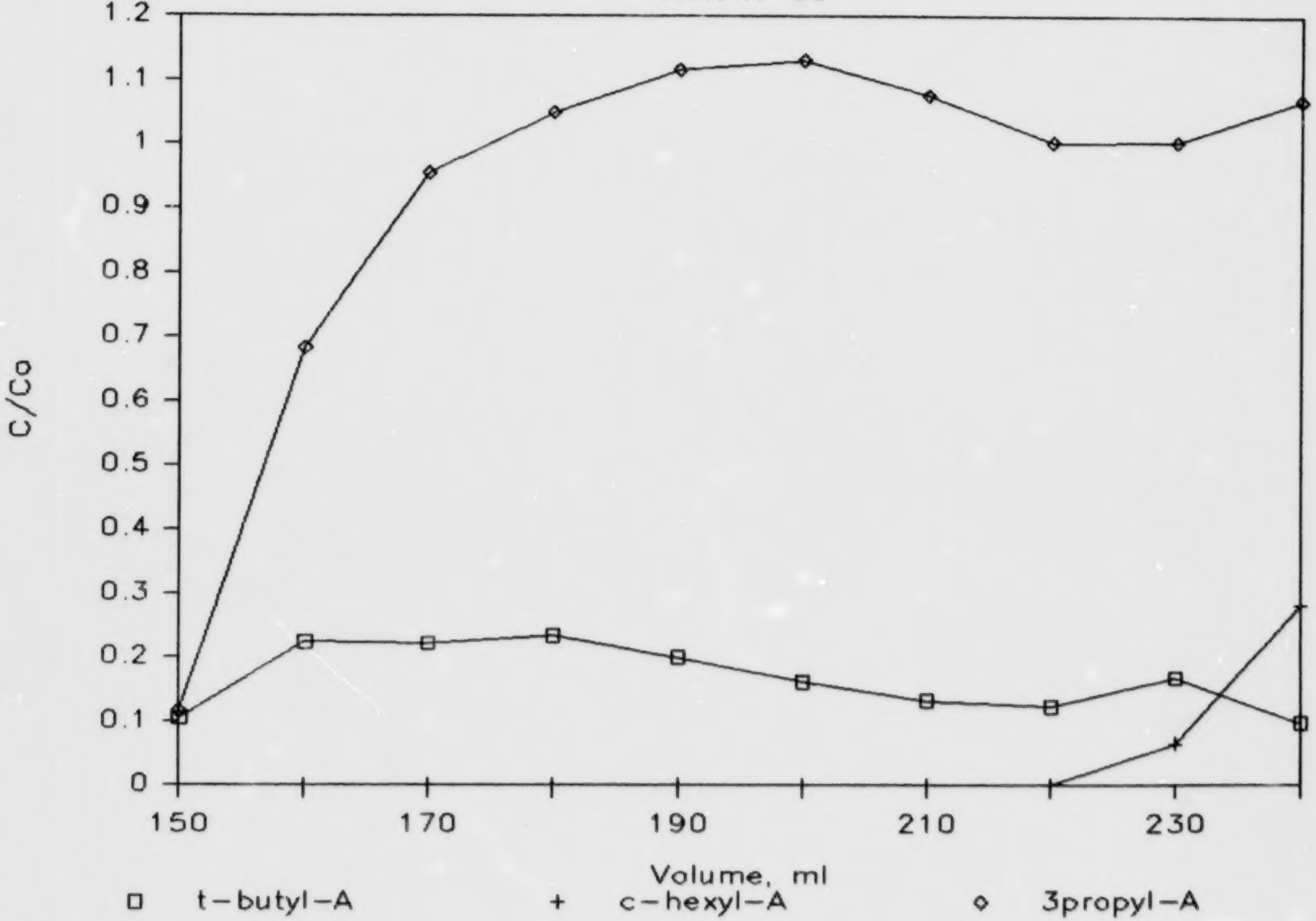
N-COMPOUNDS BREAKTHROUGH CURVES

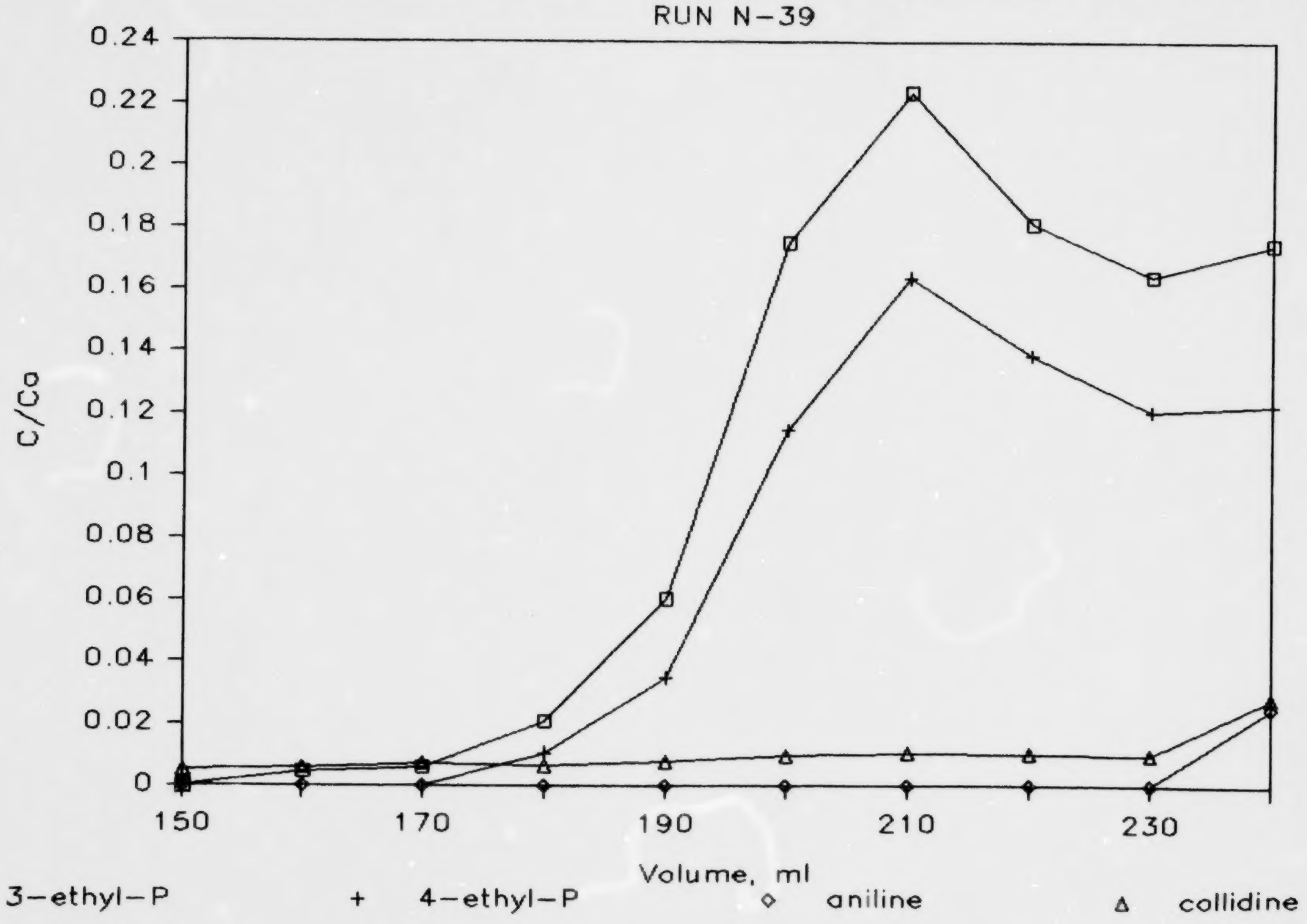
RUN N-23



N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–39

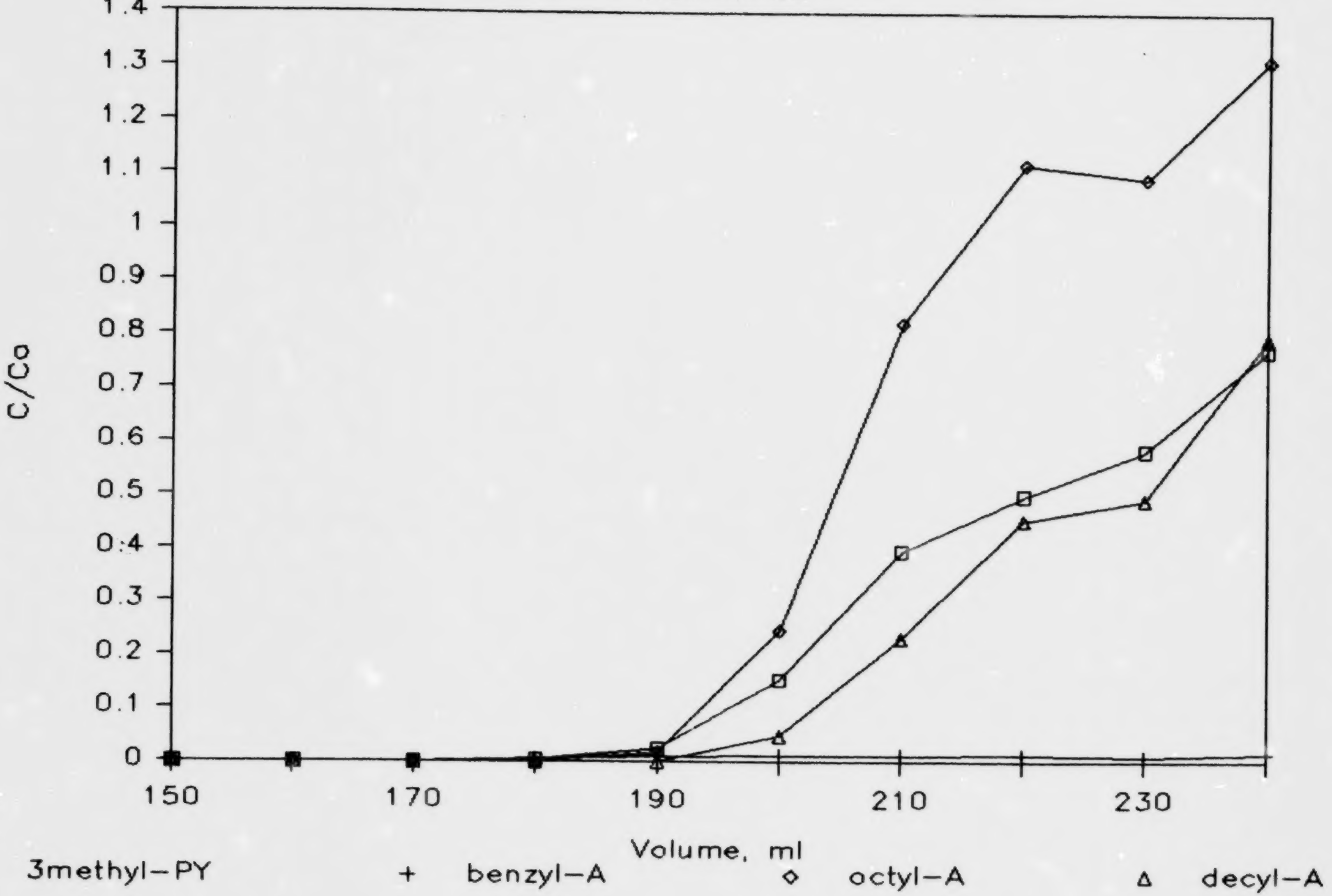




N-COMPOUNDS BREAKTHROUGH CURVES

N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-39



Run N-24: LZY-82, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	5	0	0	0	0	0	0	0	0	0	0	0
2	10	0	0	0	0	0	0	0	0	0	0	0
3	15	0	0	0	0	0	0	0	0	0	0	0
4	20	0	0	0	0	0	0	0	0	0	0	0
5	25	0	0	0	0	0	0	0	0	0	0	0
6	30	0.135506	0.125571	0.54608	0	0	0	0	0	0	0.848294	0
7	35	0.057667	0.041502	0.261839	0	0	0	0	0	0.073302	1.059284	0
8	40	0.015516	0.040651	0.188089	0	0	0	0	0	0.46713	0.644016	0
9	45	0	0.045546	0.201952	0	0	0	0	0	0.993981	0.50028	0
10	50	0	0.046914	0.162471	0	0	0	0	0	0.837191	0.371924	0.07071
11	55	0	0.020899	0.09349	0	0	0	0	0	0.632253	0.392058	0.04729
12	60	0	0	0.086614	0	0	0	0	0	0.521142	0.341023	0.03513
13	65	0	0	0.057449	0	0	0	0	0	0.520833	0.381432	0.04699
14	70	0	0	0.055229	0	0	0	0	0	0.412963	0.316135	0.055397
15	75	0	0	0.044804	0	0	0	0	0	0.358642	0.282858	0.120102
16	80	0	0	0.028058	1.442285	0	0	0	0	0.268981	0.206935	0.122955
17	85	0	0	0.019962	1.139219	0	0	0	0	0.242747	0.167226	0.101336
18	90	0	0	0.014639	0.913051	0	0	0	0	0.20463	0.151007	0.042636
19	95	0	0	0.008761	0.724242	0	0	0	0	0.16821	0.112136	0
20	100	0	0	0.00732	0.629754	0	0	0	0	0.154012	0.096756	0
21	105	0	0	0.0061	0.54783	0	0	0	0	0.146142	0.088786	0
22	110	0	0	0.004325	0.428715	0	0	0	0	0.122685	0.068093	0
23	115	0	0	0.002994	0.318144	0	0	0	0	0.100309	0.050615	0
24	120	0	0	0.002329	0.219802	0	0	0	0	0.078241	0.035794	0
25	125	0.014223	0	0.002551	0.181772	0	0	0	0	0.06142	0.02363	0.005405
26	130	0.018878	0	0.002329	0.11811	0	0	0	0	0.03071	0.014541	0.009758
27	135	0.01655	0	0.002662	0.111409	0	0	0	0	0.022222	0.014961	0.022819
28	140	0.01474	0	0	0.107221	0	0	0	0	0.016204	0.009368	0.025822
29	145	0.014999	0	0.003216	0.136874	0	0	0	0	0.019444	0.010347	0.053145
30	150	0.021722	0	0.002329	0.121461	0	0	0	0	0.014198	0.006991	0.039484
31	155	0.026636	0	0	0.184621	0	0	0	0	0.014352	0.005034	0.04744
32	160	0.018619	0	0	0.911711	0.125346	0.737227	0	0	0.010648	0.004754	0.090377
33	165	0.0321315	0	0	1.41044	0.175978	0.678726	0.805588	0	0.0125	0.00409968	0.0609646
34	170	0.0335271	0	0	1.3549	0.181223	0.663792	0.793897	0	0.02037	0.00539693	0.0595855
35	175	0.0553339	0	0	1.65125		0.596343	0.988292	0	0.010648	0.00409313	0.0806174
36	180	0.053013	0	0	1.845458	0.165404	0.6120425	1.143234	0	0.019753	0.003915	0.115151
37	185	0.074754	0	0	1.65382	0.162151	0.538803	1.053002	0	0.023611	0.00671	0.092631
38	190	0.111743	0	0	1.665046		0.507379	1.104912	0	0.01034	0.003215	0.085285
39	195	0.131143	0	0	1.668733	0.232822	0.533724	1.165797	0	0.012809	0.005173	0.066816
40	200	0.159855	0	0	1.516588	0.2624	0.500872	1.112431	0	0.005401		0.063363
41	205	0.193481	0	0.003216	1.377848	0.291846	0.471671	1.039053	0	0.010957	0.006152	0.049496
42	210	0.23435	0	0.005767	1.317526	0.342756	0.469607	1.040024	0	0.012654	0.00755	0.075782
43	215	0.252974	0	0.007542	1.346012	0.426907	0.488493	1.087568	0	0.015586	0.027544	0.099832
44	220	0.291257	0	0.011202	1.234584	0.483968	0.459609	1.033838	0	0.015278	0.032857	0.100251
45	225	0.30419	0	0.016858	1.192526	0.548095	0.445643	1.012007	0	0.01034	0.030341	0.084172
46	230	0.306259	0	0.016969	1.10087	0.661824	0.431836	0.961309	0	0	0.040128	0.083053
47	235	0.327728	0	0.019077	1.040214	0.639837	0.391525	0.917283	0	0	0.037192	0.089625
48	240	0.322038	0	0.02185	1.001508	0.755921	0.429138	0.908308	0	0	0.055928	0.089625

Run N-24: LZY-82, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
49	245	0.352819	0	0.025175	0.94409	0.791818	0.429598	0.884403	0	0	0.052709	0.101338
50	250	0.319192	0	0.031721	0.915214	0.802381	0.407554	0.839053	0	0	0.055928	0.070329
51	255	0.36032	0	0.035381	0.919235	0.852375	0.421202	0.858095	0	0	0.062639	0.097315
52	260	0.403157	0	0.038594	0.894833	0.855153	0.408809	0.831074	0	0	0.053128	0.101639
53	265	0.389032	0	0.04181	0.913203	0.88758	0.410887	0.873277	0	0	0.065711	0.119369
54	270	0.375581	0	0.041703	0.837969	0.83366	0.38724	0.769105	0	0	0.063474	0.112612
55	275	0.390584	0	0.04492	0.829591	0.846747	0.40184	0.777683	0	0	0.071588	0.112762
56	280	0.393171	0	0.048358	0.825737	0.844392	0.400095	0.77174	0	0	0.074244	0.115915
57	285	0.370408	0	0.056677	0.893599	0.926711	0.449769	0.854578	0	0	0.09298	0.15
58	290	0.384117	0	0.056122	0.832272	0.852113	0.405173	0.779138	0	0	0.068372	0.125825
59	295	0.436109	0	0.062666	0.864776	0.879989	0.42025	0.810673	0	0	0.103467	0.139339
60	300	0.392912	0	0.069543	0.9251	0.967936	0.465322	0.89909	0	0	0.106543	0.164264

Run N-25: LZY-72, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	5	0	0	0	0	0	0	0	0	0	0	0
2	10	0	0	0	0	0	0	0	0	0	0	0
3	15	0	0	0	0	0	0	0	0	0	0	0
4	20	0	0	0	0	0	0	0	0	0	0	0
5	25	0	0	0	0	0	0	0	0	0	0	0
6	30	0	0	0	0	0	0	0	0	0	0	0
7	35	0	0	0	0	0	0	0	0	0	0	0
8	40	0	0	0	0	0	0	0	0	0	0	0
9	45	0.026608	0	0	0	0.0265202	0.09356	0.096558	0.056487	0.017444	0.00733	0.036099
11	55	0.039172	0	0	0	0.32763	0.059399	0.030501	0.032967	0.024304	0.009645	0
13	65	0.034738	0	0	0	0.494335	0.07376	0.01892	0.045884	0.045472	0.022762	0
15	75	0.029194	0	0	0	0.498497	0.072019	0.017126	0.044534	0.046648	0.021798	0
17	85	0.03252	0	0	0	0.524624	0.08007	0.020388	0.048776	0.073697	0.037616	0
19	95	0.025108	0	0	0	0.423815	0.064186	0.012722	0.03316	0.088985	0.041667	0
21	105	0.025108	0	0	0	0.315467	0.0627501	0.01157	0.02352	0.137506	0.0741831	0
23	115	0.0256547	0	0	0	0.245726	0.05808366	0.0213425	0.015616	0.134827	0.048032	0
25	125	0	0	0	0	0.118729	0.0260186	0.00689366	0.008097	0.0666521	0.011767	0
27	135	0	0	0	0	0.0215324	0.0190988	0.00675157	0	0.0254219	0	0
29	145	0	0	0	0.0217523	0.0100297	0.799924	0.0284675	0	0	0	0
31	155	0.219135	0	0	0.0269613	0.0202753	1.79154	0.102535	0	0	0	0.00969232
33	165	1.16051	0	0	0.592989	0.0464982	1.56275	0.858953	0	0	0	0
35	175	1.09193	0	0	0.106312	0.0272703	0.796438	1.64733	0	0	0	0
37	185	1.21835	0	0	0.54254	0	0.725436	2.20265	0	0	0	0.039005
39	195	0.98684	0	0	1.13449	0	0.649528	1.93758	0	0	0	0
41	205	1.01058	0	0	1.79694	0	0.634631	1.68595	0	0	0	0
43	215	0.801458	0	0.0125209	2.19276	0	0.633939	1.47669	0	0	0	0.014154
45	225	0.808539	0	0.0194351	2.17258	0	0.586814	1.28493	0	0	0	0.0286285
47	235	0.958856	0.164111	0.0399191	1.86489	0.454224	0.620715	1.31954	0	0	0	0.0294898

n N-26: Silica Titania , 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

						C/Co					
ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
10	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0
60	0.015148	0	0.8506	0.456729	0.209529	0.590227	1.503367	1.68411	0.014968	0	0.166648
70	0.177984	0	0.882923	0.920006	0.681975	0.850516	0.814858	0.587235	0	0	0.049352
80	0.292255	0.105072	0.807117	0.985966	0.944661	0.700895	0.676537	0.520536	0	0	0.008563
90	0.390706	0.951365	0.839124	0.924372	0.9124	0.698692	0.690326	0.559334	0.036677	0	0.00507
100	0.371429	1.614824	0.811223	0.799158	0.790241	0.657949	0.614003	0.687822	0.084008	0	0
110	0.412737	1.588557	0.835018	0.759551	0.751206	0.621886	0.616462	0.523291	0.253506	0	0
120	0.55938	1.353966	0.861129	0.753937	0.750057	0.619546	0.6248	0.558017	0.481122	0.041641	0
130	0.553873	1.292328	0.826385	0.796351	0.772331	0.635926	0.655371	0.556221	0.558252	0.152277	0
140	0.630293	1.13186	0.802169	0.68174	0.668312	0.558431	0.558431	0.490839	0.428533	0.217243	0
150	0.65852	1.045254	0.736471	0.596445	0.580367	0.490571	0.482202	0.434798	0.346818	0.289046	0
160	0.69432	0.99896	0.745104	0.653672	0.636739	0.563799	0.55799	0.502694	0.450647	0.455733	0
170	0.625473	1.22107	0.972626	1.08514	1.030884	0.957054	1.019669	0.818345	0.789509	0.875443	0.07662
180	0.663339	1.190117	0.9502	1.073133	1.040758	0.962285	1.027044	1.150521	0.781284	0.913665	0.117296
190	0.674355	1.127178	0.973573	1.085451	1.057894	0.978114	1.025869	0.82074	0.775081	0.883869	0.140732
200	0.71256	0.949805	0.796168	0.731795	0.716303	0.671989	0.660182	0.587235	0.502697	0.5312	0.143437
210	0.741136	1.053836	0.950832	1.048183	1.006315	0.947832	1.026296	0.817627	0.752562	0.87935	0.276958
220	0.719449	1.106632	0.952622	1.062685	0.959587	0.963524	0.748263	0.800263	0.743123	0.871779	0.319324
230	0.692599	1.087646	1.015161	1.108062	1.037658	1.076807	1.099198	0.932343	0.794229	0.920381	0.425803
240	0.657487	1.087906	1.021268	1.11196	1.040873	1.089195	1.082309	0.930308	0.800566	0.867139	0.480113

Run N-27: Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0.029032	0.230694	0.212791	0.435077	0.412862	0.151838	0.023819	0.013082	0.246285
6	60	0	0	0	0	0.051954	0.012802	0.016704	0	0	0	0
7	70	0.017422	0	0	0	0.058832	0.013899	0.006125	0	0.017958	0	0
8	80	0.015513	0	0	0	0.10742	0.020117	0	0	0.043289	0.009857	0
9	90	0.01432	0	0	0	0.099663	0.017557	0	0	0.082798	0.016667	0
10	100	0.01432	0	0	0	0.093517	0.016094	0	0	0.062949	0.016487	0
11	110	0.012411	0	0	0	0.09981	0.015545	0	0	0.073913	0.01147	0
12	120	0	0	0	0	0.070833	0.079371	0	0	0.068053	0.014158	0
13	130	0	0	0	0.008797	0.025611	1.012436	0	0	0.034783	0.004659	0
14	140	0	0	0	0.486608	0.084736	1.34327	0.023107	0	0.018147	0	0
15	150	0.021718	0	0	1.747801	0.462023	0.813643	0.016147	0	0	0	0
16	160	0.433174	0	0	1.827175	1.192595	0.759144	0.034243	0	0	0	0
17	170	0.818616	0	0	1.175758	1.220986	0.615947	0.173859	0	0	0	0
18	180	0.6358	0	0	1.139394	1.244841	0.722751	0.740674	0	0	0	0.009099
19	190	0.606205	0	0	0.941935	0.989317	0.623263	1.064866	0	0	0	0.010616
20	200	0.596659	0	0	0.957185	1.000732	0.655084	1.33157	0	0	0	0.017137
21	210	0.567064	0.158576	0	1.165396	1.152642	0.764996	1.623747	0	0	0	0.056567
22	220	0.46611	0.12696	0	0.755816	0.774038	0.48921	1.021854	0	0	0	0.029299
23	230	0.4821	0.193179	0	0.709286	0.736133	0.543892	0.947244	0	0	0	0.031089
24	240	0.446539	0.200896	0	0.728641	0.744329	0.542977	0.956013	0	0	0	0.023961

Run N-28: Atapulgite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0.091887	0.134055	0.131492	0.160496	0	0	0	0
6	60	0	0	0	0	0	0.01335	0	0	0	0	0
7	70	0	0	0	0.009189	0	0.244696	0.215061	0	0	0	0
8	80	0	0	0	0.067253	0	0.98921	1.283964	0	0	0	0.051562
9	90	0.280907	0	0.046623	1.33998	0.255086	0.673555	1.09201	0	0	0	0.092508
10	100	0.288305	0.069953	0.173822	1.069795	0.913508	0.63387	0.823775	0.252436	0	0	0.07704
12	120	0.319093	0.42121	0.323656	0.739394	0.87575	0.548464	0.63544	0.32034	0	0	0.036245
13	130	0.364439	0.478218	0.363513	0.663343	0.757208	0.499451	0.569738	0.320025	0.058979	0	0.038823
14	140	0.404535	0.50834	0.427728	0.735484	0.812966	0.573336	0.649916	0.386042	0.098866	0.090681	0.078253
15	150	0.399284	0.5412	0.456145	0.780059	0.833455	0.619056	0.700306	0.425652	0.129301	0.181183	0.070519
16	160	0.40716	0.573562	0.522204	0.895992	0.923167	0.720556	0.81431	0.503615	0.177316	0.261649	0.119654
17	170	0.357995	0.585761	0.526387	0.834604	0.849407	0.666423	0.740535	0.474065	0.177127	0.241219	0.116924
18	180	0.359189	0.565098	0.511748	0.823069	0.827455	0.678859	0.726197	0.463219	0.184688	0.246595	0.164392
19	190	0.357041	0.593727	0.538566	0.836364	0.821308	0.690746	0.756821	0.494499	0.178261	0.229928	0.109342
20	200	0.332697	0.680607	0.745479	2.242424	2.137129	1.983541	2.302339	1.128104	0.50983	0.701075	0.178192
21	210	0.353938	0.517301	0.5163	0.871163	0.856139	0.734638	0.825306	0.520277	0.202647	0.264875	0.715954
22	220	0.313126	0.552153	0.530447	0.830303	0.787063	0.647403	0.72912	0.479723	0.19811	0.248746	0.155899
23	230	0.355131	0.521285	0.518391	0.763245	0.74711	0.635333	0.696687	0.475008	0.165028	0.222939	0.175311
24	240	0.352029	0.588499	0.61951	1.240274	1.150739	1.018654	1.217149	0.711254	0.268809	0.370968	0.361541

Run N-29: Carbon RZN-1, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0.0254115	0.0407704	0.0677611	0.046647	0.019603	0	0	0
6	60	0	0	0	0	0	0.0233344	0.00875592	0	0	0	0
7	70	0	0	0	0	0	0.0143692	0	0	0	0	0
8	80	0	0	0	0	0	0.0133219	0	0	0	0	0
9	90	0	0	0	0	0	0	0	0	0	0	0
10	100	0	0	0	0	0	0	0	0	0	0	0
11	110	0	0	0	0	0	0	0	0	0	0	0
12	120	0	0	0	0	0	0.014028	0	0	0	0	0
13	130	0	0	0	0	0	0.746349	0.0331712	0	0	0	0
14	140	0	0	0	0	0	1.28376	0.629954	0	0	0	0
15	150	0.963117	0	0	0	0	0.900189	1.40283	0	0	0	0
16	160	2.67215	0	0	0	0	0.94518	1.698127	0	0	0	0
17	170	2.86767	0	0	0.245932	0	1.0086	1.82642	0	0	0	0
18	180	2.2208	0	0	1.1413	0.229633	0.729957	1.21483	0	0	0	0
19	190	1.93098	0	0.002985	1.678443	0.433309	0.409375	1.14045	0	0	0	0
20	200	2.19629	0	0	1.66282	1.02985	0.711808	1.05663	0	0	0	0
21	210	2.16508	0	0	1.28488	1.14382	0.681581	0.900034	0	0	0	0
22	220	2.06909	0	0	1.18248	1.2351	0.722	0.917344	0	0	0	0
23	230	2.17662	0	0.00469613	1.1242	1.2193	0.723256	0.906772	0	0	0	0
24	240	2.02558	0	0	1.33468	1.46761	0.92423	1.12032	0	0	0	0

Run N-30: Carbon RFN-2, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0.0176235	0.777847	0.645212	0.279364	0.991373	0	0	0	0.0725136
6	60	0.266043	0	0	0.017955	0.027115	0.0227698	0.0366985	0	0	0	0
7	70	0.82934	0	0	0	0	0	0.0129508	0	0	0	0
8	80	0.787923	0	0	0	0	0	0.00820982	0	0	0	0
9	90	0.770719	0	0	0	0	0.0237649	0.00859095	0	0	0	0
10	100	0.724586	0	0	0	0	0.193525	0.0661646	0	0	0	0
11	110	0.645723	0	0	0.0159153	0	0.5411	0.300305	0	0	0	0
12	120	0.752127	0	0	0.375755	0.129688	0.629582	0.556255	0	0	0	0
13	130	0.484858	0	0.00539598	0.822939	0.356448	0.598766	0.732546	0	0	0	0
14	140	0.503218	0	0.0103205	0.945734	0.624493	0.633887	0.875448	0	0	0	0
15	150	1.21217	0	0.0125295	0.865487	0.681835	0.592479	0.831947	0	0	0	0
16	160	1.30939	0	0.0145604	0.886543	0.750255	0.589135	0.882003	0	0	0	0
17	170	1.43949	0	0.0176508	0.905203	0.824303	0.649919	0.942863	0	0	0	0
18	180	1.2907	0	0.0197949	0.948884	0.853727	0.634315	0.959418	0	0	0	0
19	190	1.32262	0	0.0201089	0.867221	0.755296	0.535065	0.839599	0	0	0	0
20	200	1.24287	0	0.022107	0.959912	0.898853	0.651036	0.968209	0	0	0	0
21	210	1.26384	0	0.021965	0.930751	0.880267	0.646333	0.943646	0	0	0	0
22	220	1.22423	0	0.0226756	0.968356	0.911201	0.672869	0.971667	0	0	0	0
23	230	1.19122	0	0.0223447	0.975116	0.917118	0.672075	0.97438	0	0	0	0.00679171
24	240	1.26286	0	0.0219763	0.949351	0.894542	0.648446	0.933091	0	0	0	0.014469

Run N-32: IRN-77, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0	0	0	0	0	0	0	0
6	60	0	0	0	0	0	0	0	0	0	0	0
7	70	0.713158	1.163057	1.142308	1.145006	1.168215	1.233671	1.155793	1.249203	1.111038	1.195632	0.990613
8	80	0.697831	1.204882	1.174472	1.141154	1.171946	1.221748	1.140018	1.279177	1.08957	1.138636	0.944521
9	90	0.642472	1.192318	1.151505	1.096992	1.117912	1.132053	1.072065	1.192237	0.99271	1.036483	0.700007
10	100	0.814169	1.12783	1.073226	0.97741	0.996833	0.991745	0.951398	1.066992	0.860169	0.9092	0.515703
11	110	0.764217	1.168608	1.129143	1.079672	1.113487	1.138434	1.062701	1.196086	1.015263	1.059704	0.649334
12	120	0.764437	1.169002	1.147513	1.09899	1.135491	1.166593	1.089605	1.228468	1.058057	1.119694	0.822348
13	130	0.672401	1.157583	1.088976	0.959417	0.98966	0.975583	0.903124	1.052711	0.847524	0.886607	0.547166
14	140	0.75154	1.197182	1.158644	1.071968	1.102967	1.089611	1.026579	1.18685	0.968918	1.031485	0.622315
15	150	0.849729	0.600938	1.194103	1.208569	1.250038	1.331941	1.23151	1.368755	1.197018	1.264556	1.101954
16	160	0.747292	0.573544	1.15069	1.169309	1.228716	1.3928	1.22537	1.363162	1.20536	1.249217	1.649336
17	170	0.724955	0.599951	1.267252	1.39128	1.47722	1.757955	1.510047	1.663497	1.598864	1.666667	2.589049
18	180	0.902076	0.588722	1.124216	1.114383	1.129008	1.205449	1.134105	1.23103	1.074547	1.118753	1.230642
19	190	0.806634	0.612043	1.192472	1.219328	1.248811	1.361973	1.271421	1.35645	1.258253	1.338281	1.547198
20	200	0.879738	0.605997	1.147051	1.184975	1.19819	1.293158	1.219369	1.292692	1.184416	1.227775	1.338127
21	210	0.770307	0.60575	1.075282	1.050963	1.024083	1.177009	0.983394	0.995339	0.979766	1.027214	0.884403
22	220	0.961868	0.572187	1.113174	1.136089	1.128547	1.223349	1.170248	1.277591	1.138978	1.204024	1.512168
23	230	0.795126	0.603282	1.118068	1.107777	1.078079	1.170446	1.13271	1.144295	1.045616	1.091704	1.095317
24	240	0.78926	0.582922	1.189084	1.204794	1.271667	1.393994	1.272956	1.40082	1.293752	1.364011	1.645833

Run N-40: LZY-52, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0.0108422	0.00857649	0.0118146	0.0173542	0.027946	0.025494	0	0.022222	0.0900914
6	60	0	0	0	0.005129	0.006592	0.01461	0.014387	0.010274	0	0.007978	0.029019
7	70	0	0	0	0	0	0.00581061	0.006357	0.004792	0	0	0
8	80	0	0	0.00227084	0.0051772	0.00764197	0.0161564	0.015513	0.009242	0	0	0.0138658
9	90	0	0	0.00223172	0.00695964	0.0104271	0.0244586	0.02052	0.011445	0	0	0.0155582
10	100	0	0	0	0	0.0054133	0.0172805	0.014693	0.008102	0	0	0.0269625
11	110	0	0	0	0	0	0.0113725	0.009778	0.00586	0	0	0.0253331
12	120	0	0	0.0066524	0	0	0	0.003617	0	0	0	0.0191555
13	130	0.0239769	0	0.264803	0	0.00538845	0	0.012491	0.005434	0	0	0.0144179
14	140	0.147791	0	0.791532	0.00828977	0.0138566	0	0.111206	0.004437	0	0	0
15	150	0.240278	0	0.750089	0.016539	0.012606	0.00716611	0.449002	0	0	0.002255	0.012231
16	160	0.278378	0	0.691486	0.0151369	0.0141574	0.0129935	0.898096	0	0	0.003531	0.00688196
17	170	0.318604	0	0.630964	0.024693	0.017486	0	0	0	0	0.005963	0.013769
18	180	0.303346	0	0.668716	0.0303352	0.0267457	0	0	0	0.0140088	0.0451539	0.0547263
19	190	0.292792	0	0.652838	0.0352027	0.0300586	0	0	0	0.0113068	0.137917	0.11429
20	200	0.308535	0.0240445	0.642863	0.0337942	0.0243698	0	0	0	0.0119168	0.203758	0.143868
21	210	0.266486	0.0975994	0.64659	0.0626944	0.0434246	0	0	0	0.0170395	0.281298	0.245291
22	220	0.239099	0.222885	0.676068	0.152629	0.0491206	0	0	0	0.0183384	0.363903	0.428014
23	230	0.249749	0.285007	0.575626	0.281401	0.0124128	0	0	0	0.00896586	0.268836	0.393547
24	240	0.26898	0.33308	0.558136	0.50972	0.015299	0	0	0	0.0106536	0.282037	0.644361

Run N-41: Ni-13X, 1 ml/min, 15 psi, 250 C, Standard soluion 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0.0661955	0.088847	0.164365	0.376881	0.051205	0.265706	0.507622	0.142623	0	0.121098	0.352696
4	40	0.0993715	0	0.011606	0.0300547	0.0277763	0.0440498	0.0838841	0.017731	0	0.0236264	0.0969276
5	50	0.062777	0	0.033757	0.00644429	0.061768	0.0201679	0.0295967	0.0199006	0	0.00228004	0.0484747
6	60	0.0982738	0	0	0.00337254	0.0629466	0.0127281	0.0188507	0.0300177	0	0.00367326	0.0264298
7	70	0.0651874	0	0	0.00377782	0.069113	0.00725372	0.00896354	0.038978	0	0.00437072	0.0128734
8	80	0.0699574	0	0	0.00606239	0.0895103	0.0076126	0.00854475	0.0291804	0	0.00578322	0.00671608
9	90	0.0628382	0	0.00180539	0.0111338	0.0916376	0.0206477	0.0252655	0.0244678	0	0.00557088	0.00837298
10	100	0.0694428	0	0	0.0121077	0.0716109	0.0234607	0.0295939	0.0218179	0	0.00481253	0.00528644
11	110	0.0695791	0	0	0.00656861	0.0555307	0.00987099	0.0111372	0.0207829	0	0.00417457	0
12	120	0.0741076	0	0	0.00747399	0.0460755	0.00749348	0.00765369	0.0324062	0	0.00419057	0
13	130	0.085944	0	0	0.0174056	0.0710403	0.00937838	0.0103526	0.0308158	0	0.00436781	0.00366864
14	140	0.0894936	0	0	0.0175234	0.12061	0.0110066	0.0126234	0.0561108	0	0.00821042	0.0108335
15	150	0.0454971	0	0	0.0122973	0.0699088	0.00994253	0.0110723	0.0187376	0	0.005161	0
16	160	0.0582122	0	0	0.00964105	0.040278	0.00589495	0.00924677	0.0157295	0	0	0
17	170	0.075532	0	0	0.0122796	0.0343501	0.00480577	0.0114208	0.0156313	0.00308458	0	0.0148359
18	180	0.125444	0	0	0.0246205	0.0412503	0.00791598	0.0232117	0.0179922	0.00600726	0.99869513	0.0646787
19	190	0.282266	0	0	0.0188591	0.0357432	0	0.0454452	0.014674	0.00292645	0.0201479	0.164826
20	200	0.275713	0	0	0.0190077	0.0466033	0	0.0313007	0.0178217	0.00268105	0.0206016	0.358767
21	210	0.474541	0	0.0603105	0.0173976	0.0263483	0.00672801	0.291783	0.0193176	0.00347755	0.0273116	0.263966
22	220	0.778467	0	0.1103	0.0292172	0.0390682	0.00329857	0	0	0.037146	0.0530876	0.373101
23	230	0.484773	0	0.182025	0.0479359	0.0497223	0	0	0	0.0163306	0.0321282	0.31655
24	240	0.460424	0	0.244968	0.0514656	0.0321571	0	0	0	0.203174	0	0.235811

Run N-75: (SbF5.FSO3H)13X HCOOH, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	14.447	0	0.00809	0.00931	0.00953	0.00531	0	0	0	0	0.01097
2	20	5.11099	0	0.00587	0.00175	0	0	0	0	0	0	0
3	30	6.3722	0	0.00429	0.00376	0.00425	0.00181	0	0	0	0	0
4	40	4.21942	0	0.00419	0.00414	0	0	0	0	0	0	0
5	50	5.836	0	0.0043	0.00674	0.00461	0	0	0	0	0	0
6	60	2.68419	0	0.0031	0.06754	0.02338	0.01548	0	0	0	0	0
7	70	9.23955	0	0.00305	0.21596	0.069849	0.0439232	0.0075765	0	0	0	0.0045847
8	80	5.09327	0	0.00579	0.3271	0.12487	0.10362	0	0	0.00474	0	0.00375
9	90	4.98929	0	0.0045526	0.43183	0.18423	0.10878	0	0	0.0063	0	0.00256
10	100	18.1891	0	0.0053599	0.39318	0.24885	0.0291871	0.55829	0	0	0	0.0043215
11	110	9.81817	0	0.03356	0.4894	0.42737	0.0794876	0.8436273	0	0	0	0.0064816
12	120	3.0467	0	0.12987	1.098469	0.94396	0.20817	1.47789	0	0	0	0.00555
13	130	1.79559	0	0.15223	0.51788	0.51569	0.1318131	0.706666	0	0	0.01088	0.0019987
14	140	1.51718	0	0.1265526	0.53883	0.5363595	0.14513	0.7886793	0.00912	0	0.01442	0.006913
15	150	1.69084	0	0.1316524	0.57043	0.5823335	0.1579642	0.7953485	0.01064	0	0.0100104	0.00168
16	160	1.63785	0	0.1895997	0.57657	0.5329489	0.1709952	0.9655598	0.01482	0	0.0163532	0.00575
17	170	9.88916	0	0.1462285	0.55463	0.5421171	0.171262	0.8565448	0.01197	0	0.00538	0.0048001
18	180	2.20009	0	0.231207	0.92274	0.8677319	0.2326129	1.0723905	0.02004	0.01457	0.01626	0.0134323
19	190	1.91931	0	0.10259	0.50017	0.5117517	0.1893914	0.7953742	0.0384	0.03087	0.0175359	0.01146
20	200	4.97431	0	0.0908914	0.45988	0.4670882	0.1677946	0.07046757	0.012813	0	0.0676	0.003358

Run N-76: (SbF5.FSO3H)13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

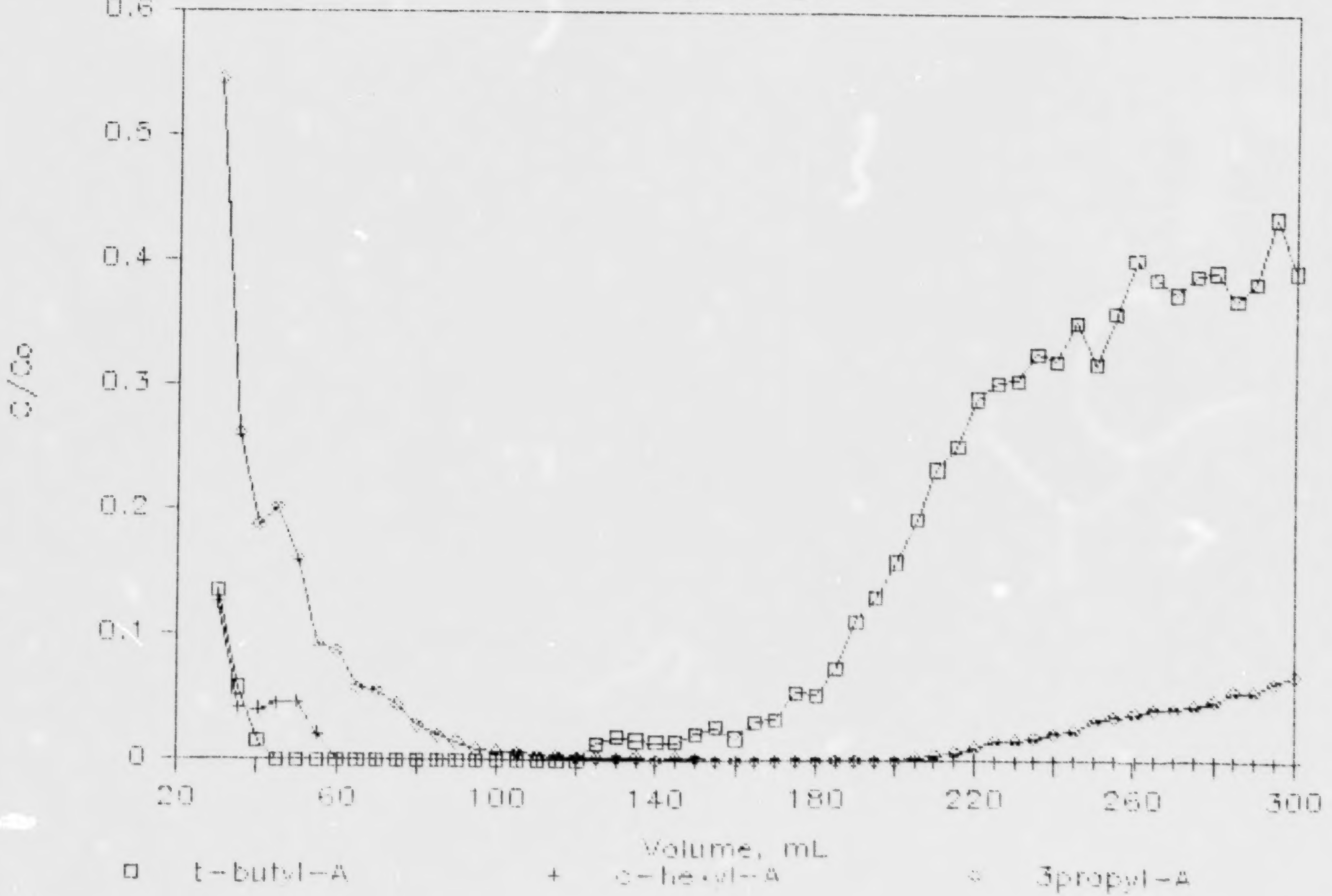
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10											
2	20											
3	30	1.36238	0	0.0061967	0.09635	0.00774	0.05107	0	0	0.004395	0.00809	0.00847
4	40	0.57922	0	0.0032006	0.0354	0.00661	0.01959	0	0	0.00638	0	0
7	70	0.84697	0	0.0019334	0.02964	0.00667	0.02066	0.0078992	0	0.0233621	0.00201	0.00617
8	80	1.02697	0	0	0.02272	0.00613	0.0136767	0.0070304	0	0.0206036	0.00213	0
9	90	0.76212	0	0.0800384	0.10029	0.00854	0.1244854	0.0756879	0.0037771	0.0180289	0.01741	0.00748
10	100	7.1011	0	0.0190376	0.03579	0.00551	0.0379875	0.0250973	0	0.0133547	0.00232	0.00508
12	120	1.0056	0	0.008202	0.03111	0.00831	0.0366923	0.0143114	0.0070549	0.0181723	0.0049885	0.0067539
13	130	3.68501	0	0.0024326	0.01104	0.0046	0.0111216	0.0011462	0	0.0067997	0.00206	0
14	140	2.54959	0	0.0048514	0.00984	0.0023795	0.14002	0	0.00418	0	0	0
18	180	5.09723	0	0.32324	0.75558	0.00377	0.1557288	0.9616291	0.01583	0.062459	0	0
19	190	1.2692184	0	0.39524	1.1423	0.1537968	0.66626	0.18952	0	0.01478	0.00999	0
20	200	2.54774	0.10669	0.36651	0.96915	0.3486907	0.57722	0.20152	0.02401	0.0137431	0.07126	0.02937
21	210	2.27731	0.1197268	0.39797	0.8298	0.5066154	0.64479	0.20125	0.02289	0.010293	0.0439408	0.0168
22	220	1.48715	0.12808	0.39564	0.7589	0.5831583	0.61872	0.20001	0.02534	0.0234085	0.0813	0.03079
23	230	2.0377118	0.17316	0.36748	0.65912	0.6103663	0.53499	0.20412	0.01187	0.0078763	0.16679	0
24	DEP	26.374134	0.6309705	0.39859	0.64537	0.603364	0.58842	0.32952	0.01901	0.52449	0.47977	0.00338

Run N-36: Dehydrated 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0.043062	0	0	0.111982	0.04229	0.153994	0.315894	0.061188	0	0	0.055309
5	50	0	0	0	0	0	0.0152438	0.025218	0.006672	0	0	0
6	60	0.0102191	0	0	0	0	0.00911845	0.012941	0.003903	0	0	0
7	70	0	0	0	0	0	0.0112049	0.013272	0.004406	0	0	0
8	80	0	0	0	0	0	0.0719294	0.00877694	0	0	0	0
9	90	0	0	0	0	0	0	0.00655223	0	0	0	0
10	100	0.0080385	0	0.0540632	0	0	0	0.00768648	0	0	0	0
11	110	0.150704	0	0.643037	0	0	0.00640106	0.0098227	0	0	0	0
12	120	0.24931	0	0.977609	0	0	0	0.00567915	0	0	0	0
13	130	0.390549	0	0.939916	0	0	0	0.00485021	0	0.0042572	0	0
14	140	0.678929	0	1.01039	0.00325269	0	0.00433793	0.00831103	0	0.00679365	0	0
15	150	0.922844	0	0.986	0.0212869	0.00704415	0.00429568	0.007631	0.008562	0.00803491	0	0
16	160	1.01145	0	0.997621	0.093318	0.0442729	0.0212793	0.022342	0.091286	0.0158415	0.171644	0.0251017
17	170	0.829995	0	1.00215	0.159391	0.1002	0.0158319	0.0200333	0.388913	0.0120986	0.720225	0.196873
18	180	0.809051	0	0.88861	0.125961	0.0906408	0.00986641	0.0118981	0.620793	0.0057179	0.82827	0.164378
19	190	0.774018	0.0255279	0.860276	0.0977951	0.0717315	0.00985778	0.0114407	0.77289	0.00548945	0.802869	0.339634
20	200	0.788688	0.132617	0.853843	0.0834581	0.0575884	0.0100259	0.0122669	0.834287	0.00777204	0.703489	0.35245
21	210	0.853009	0.432406	0.840328	0.0734821	0.0513973	0.00731545	0.00908338	0.822632	0.00500678	0.617123	0.377381
22	220	0.866868	0.831121	0.810534	0.064104	0.0478544	0.00865345	0.0166781	0.777818	0.00654716	0.519821	0.276414
23	230	0.822364	1.16959	0.8976	0.0752085	0.0608441	0.0192895	0.115945	1.00314	0.0121671	0.800345	0.930949

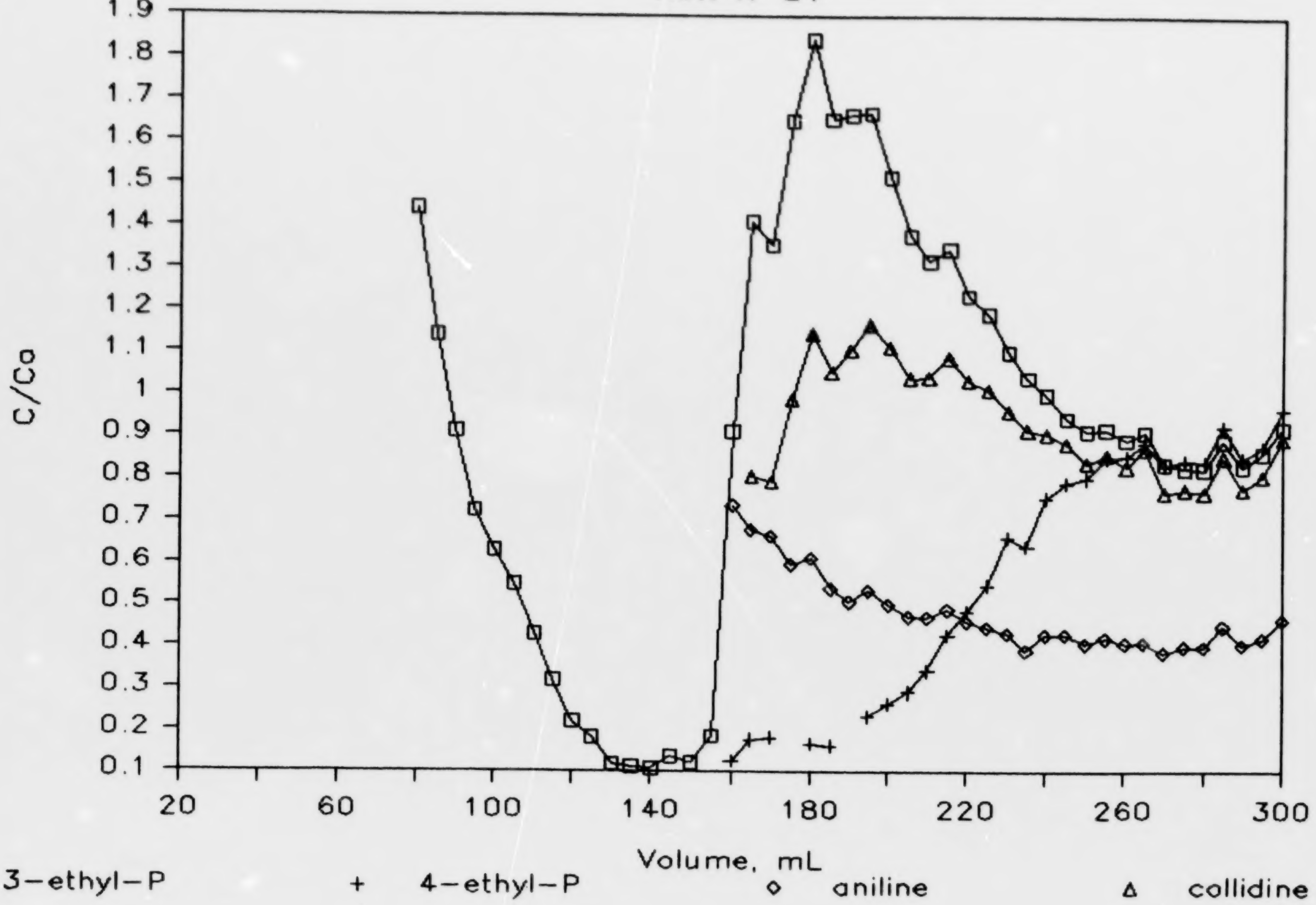
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-24



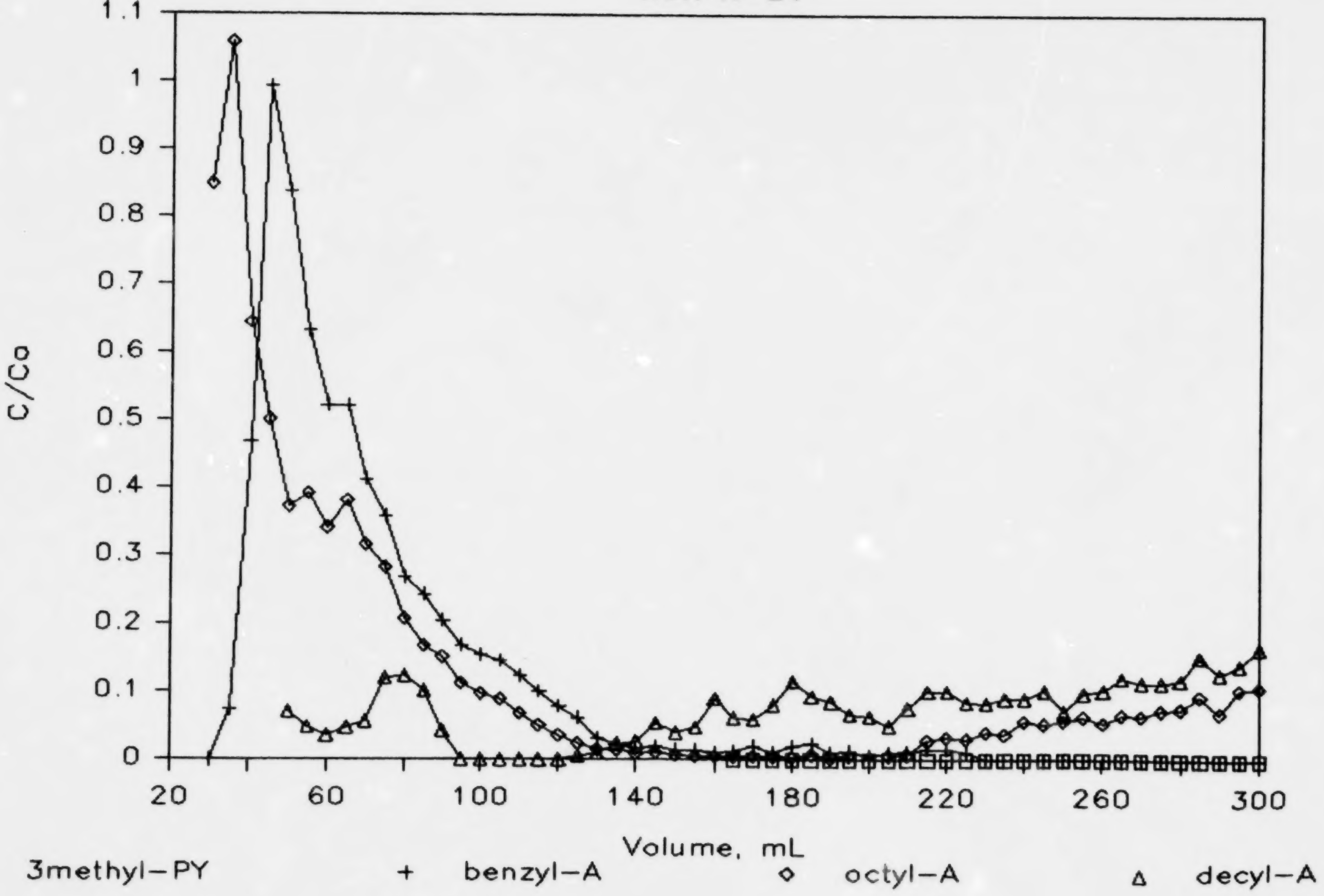
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-24



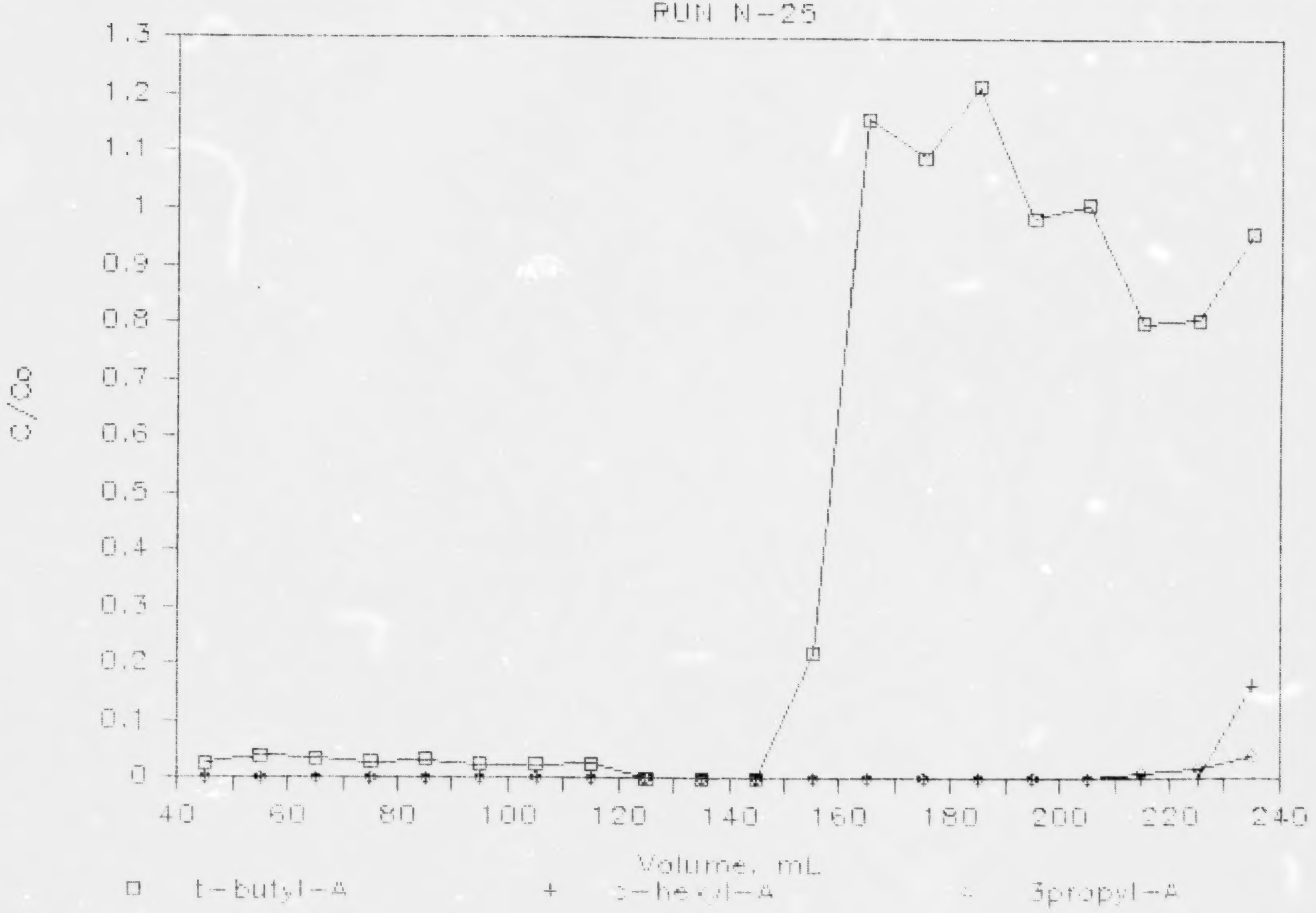
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–24



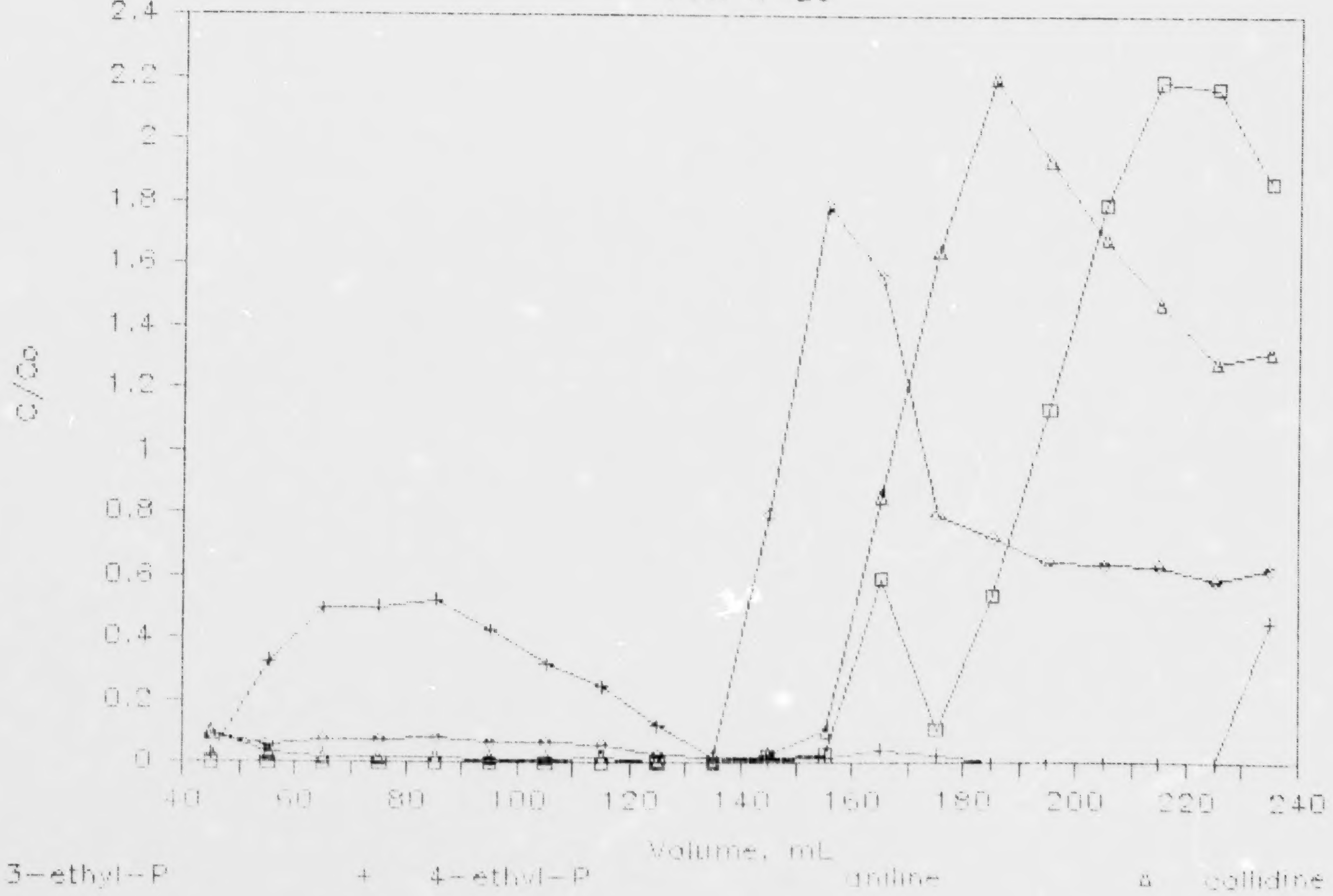
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-25



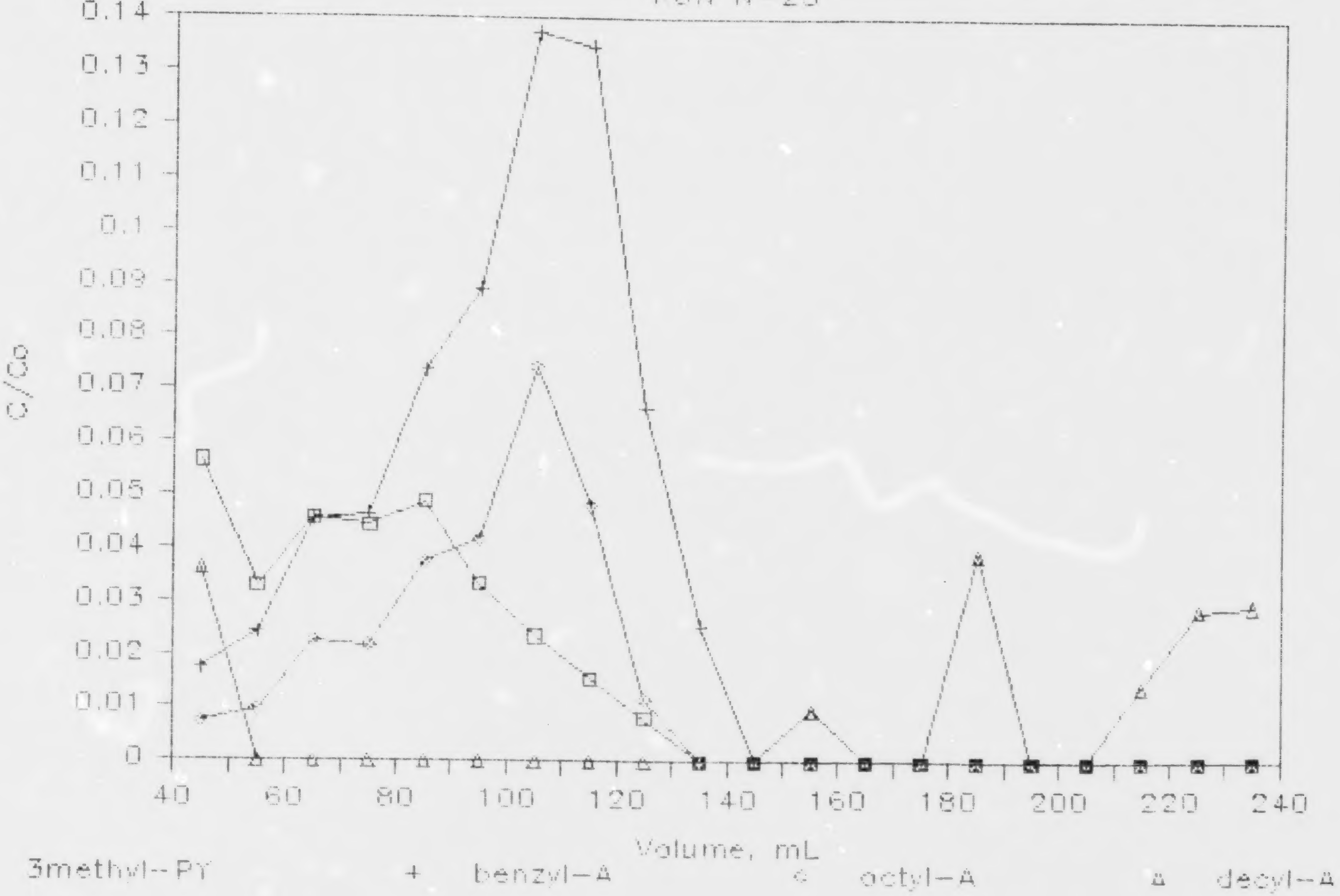
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-25

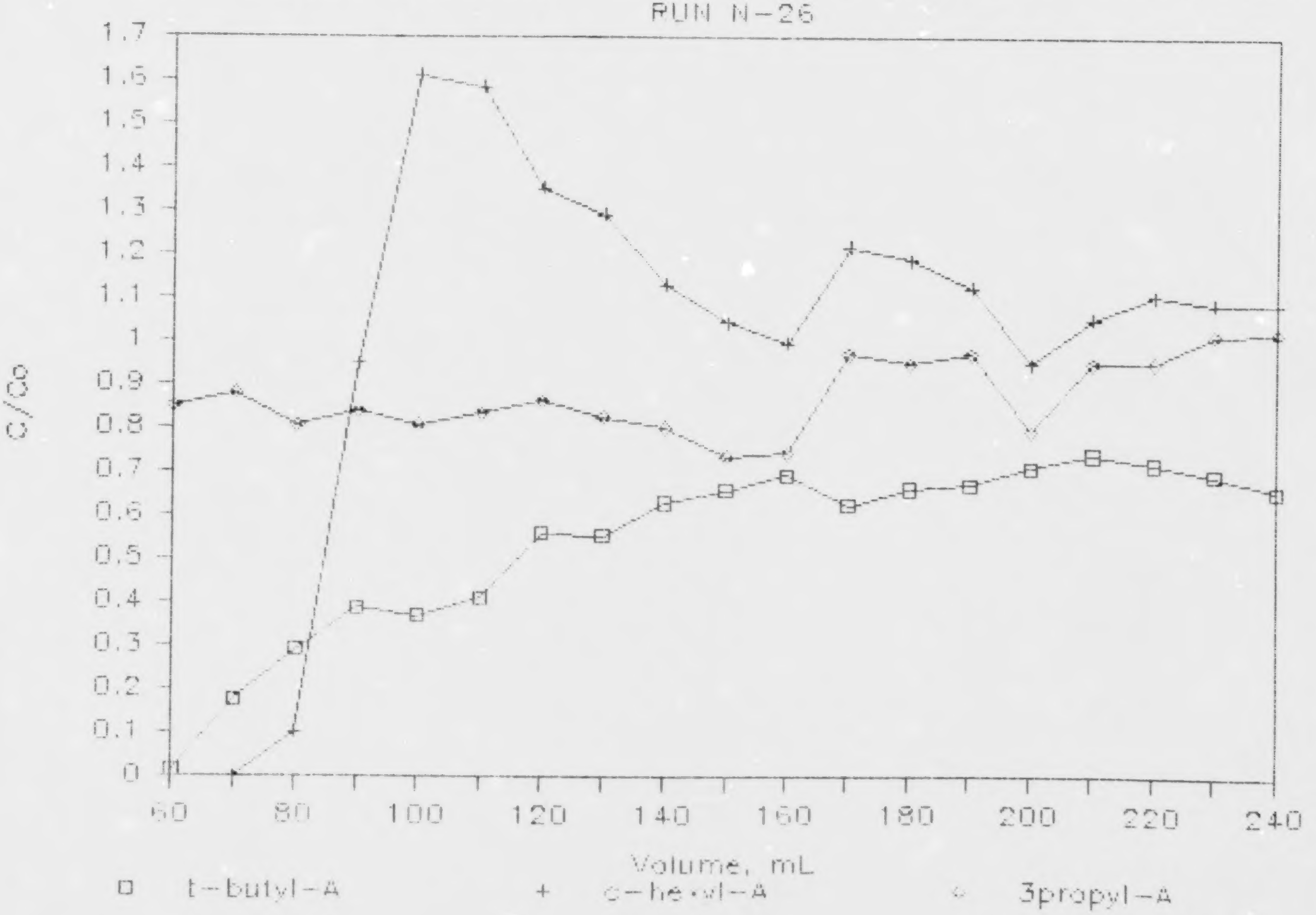


N-COMPOUNDS BREAKTHROUGH CURVES

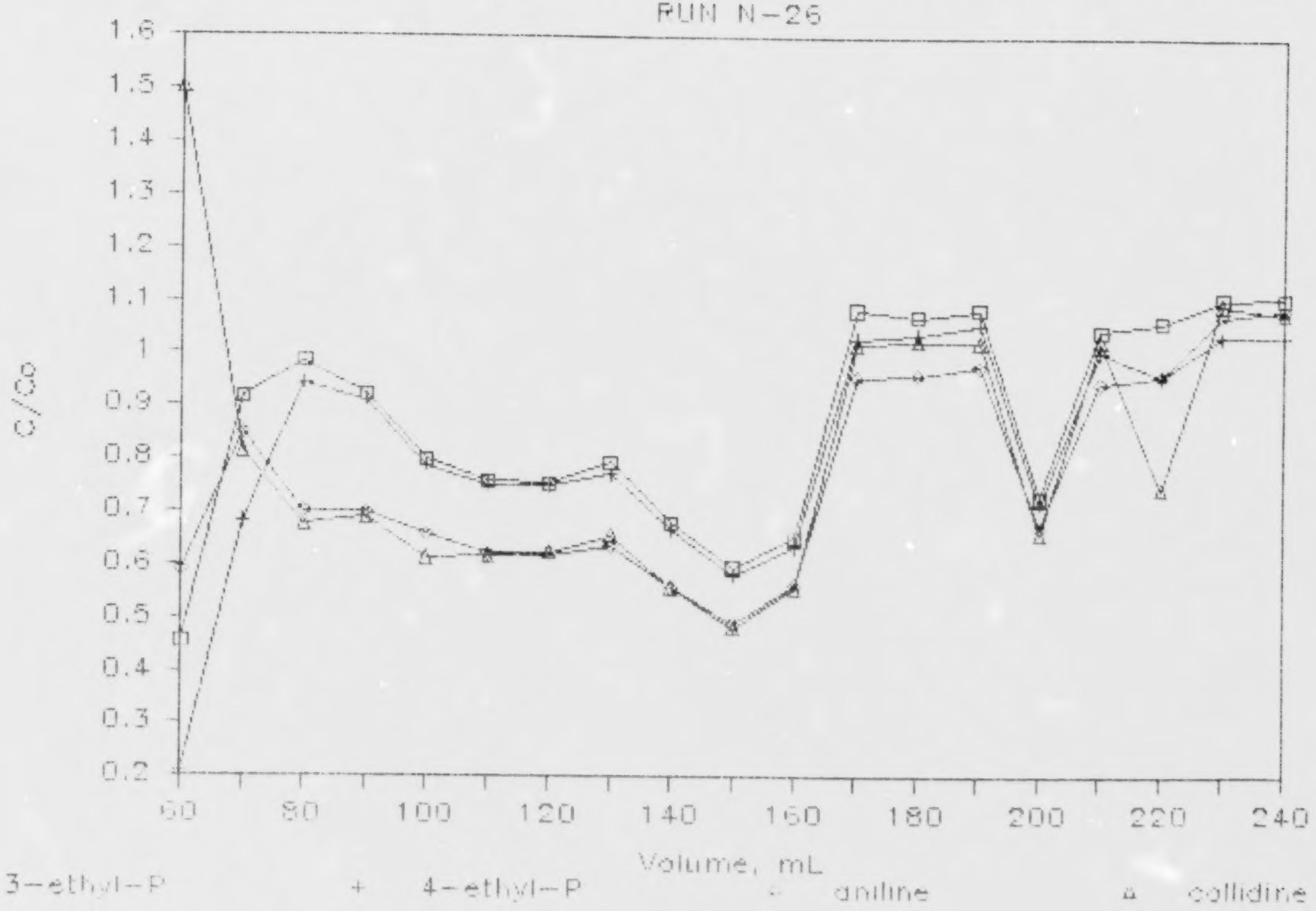
RUN N-25

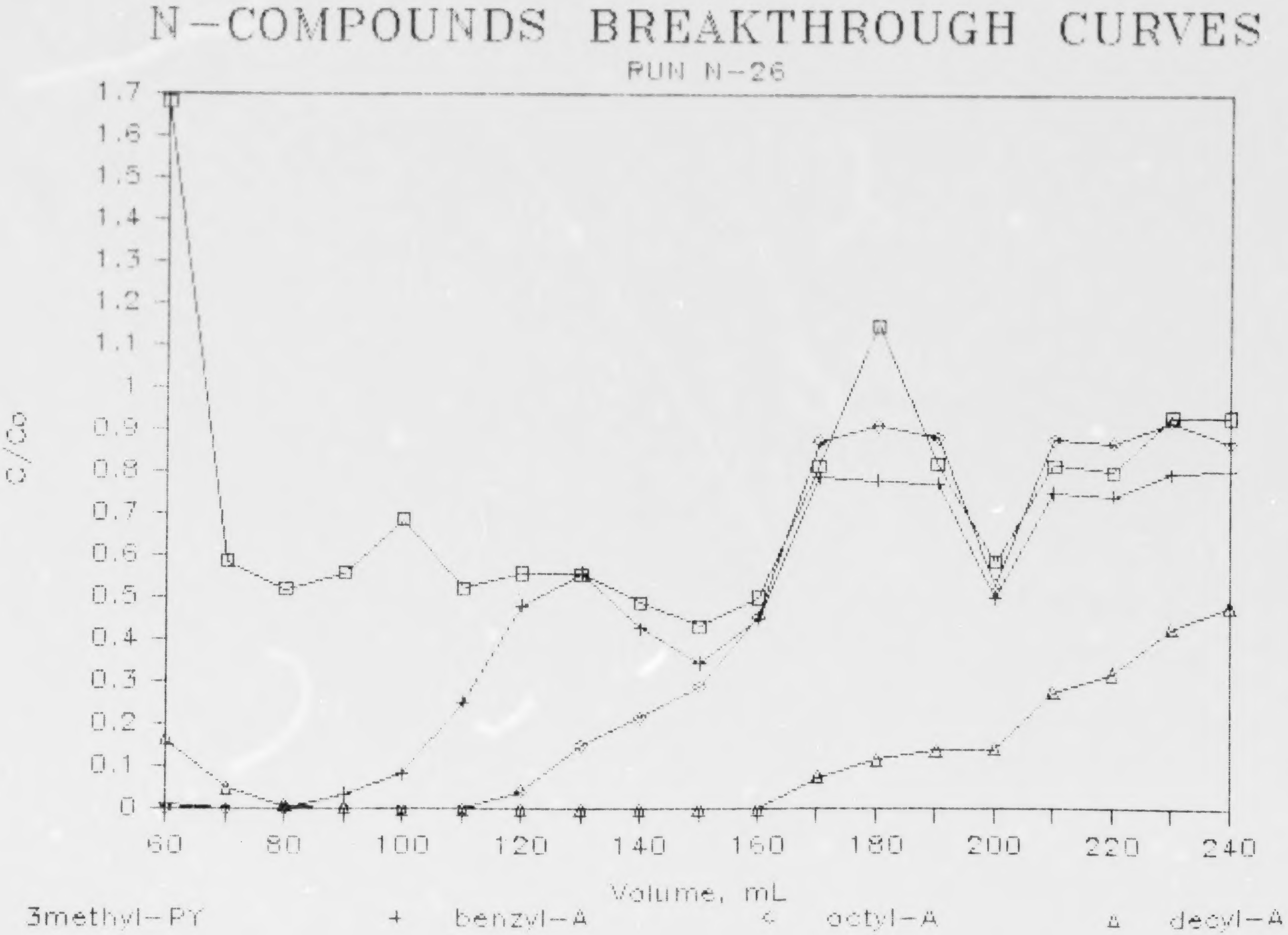


N-COMPOUNDS BREAKTHROUGH CURVES



N-COMPOUNDS BREAKTHROUGH CURVES



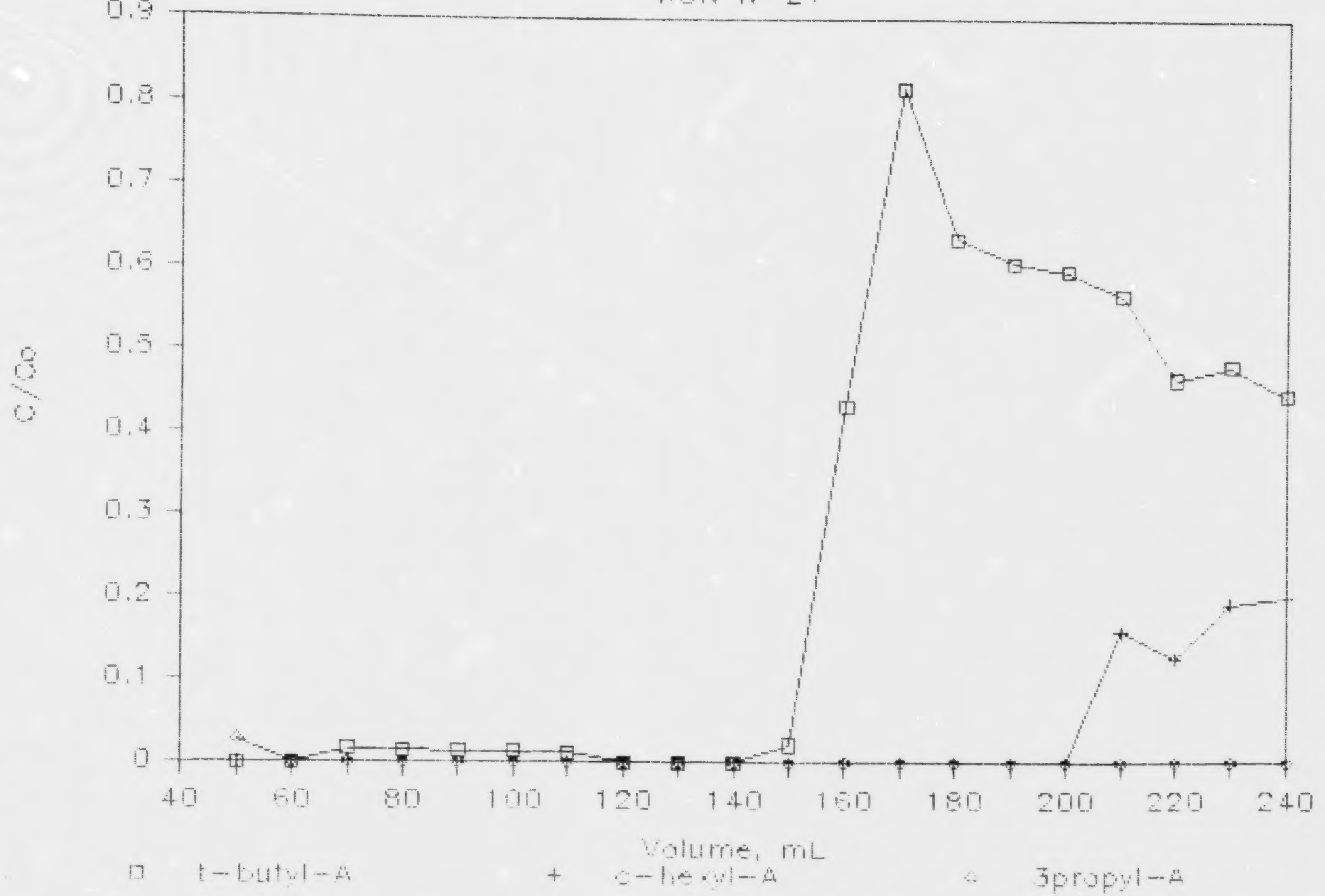


N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-26

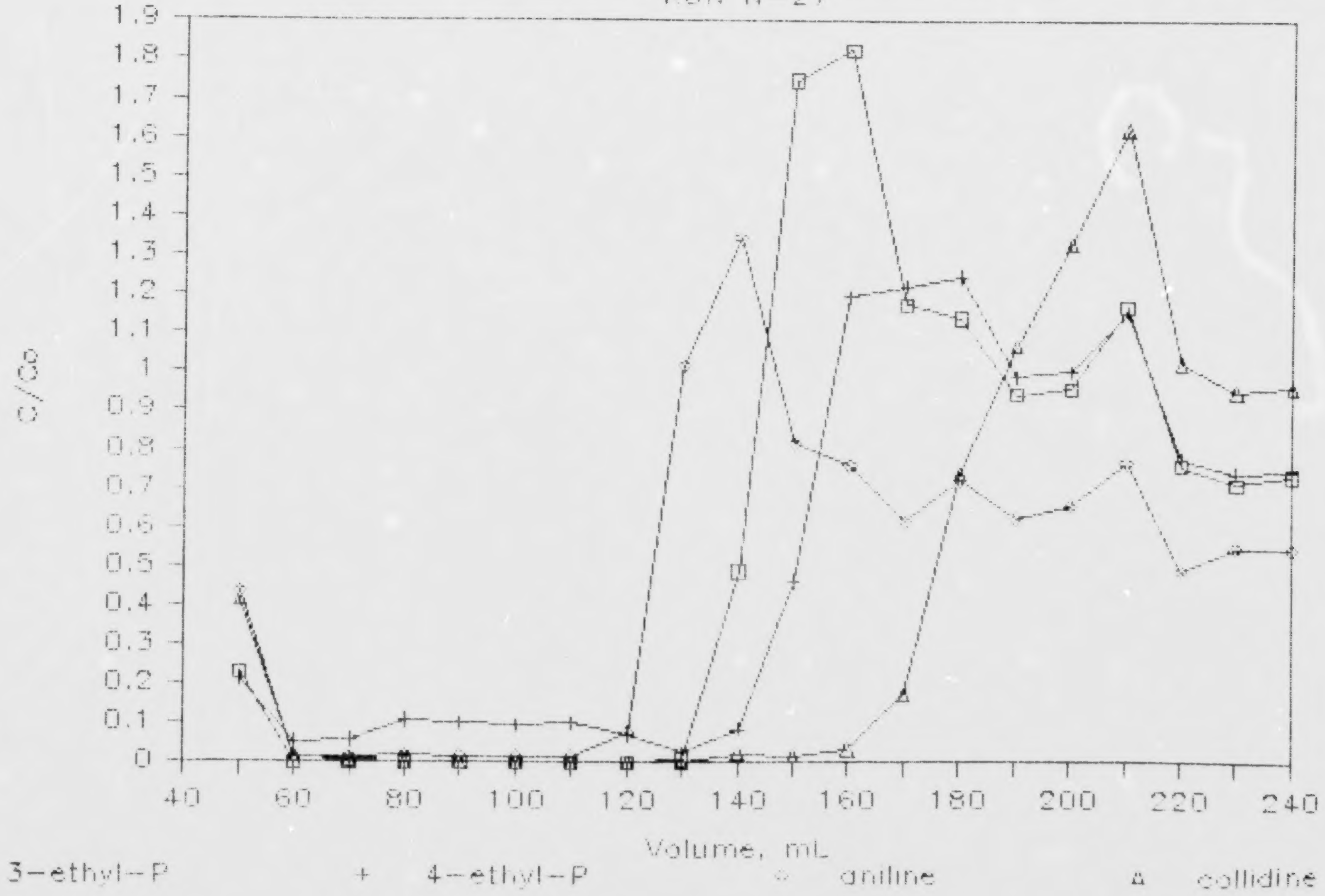
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-27



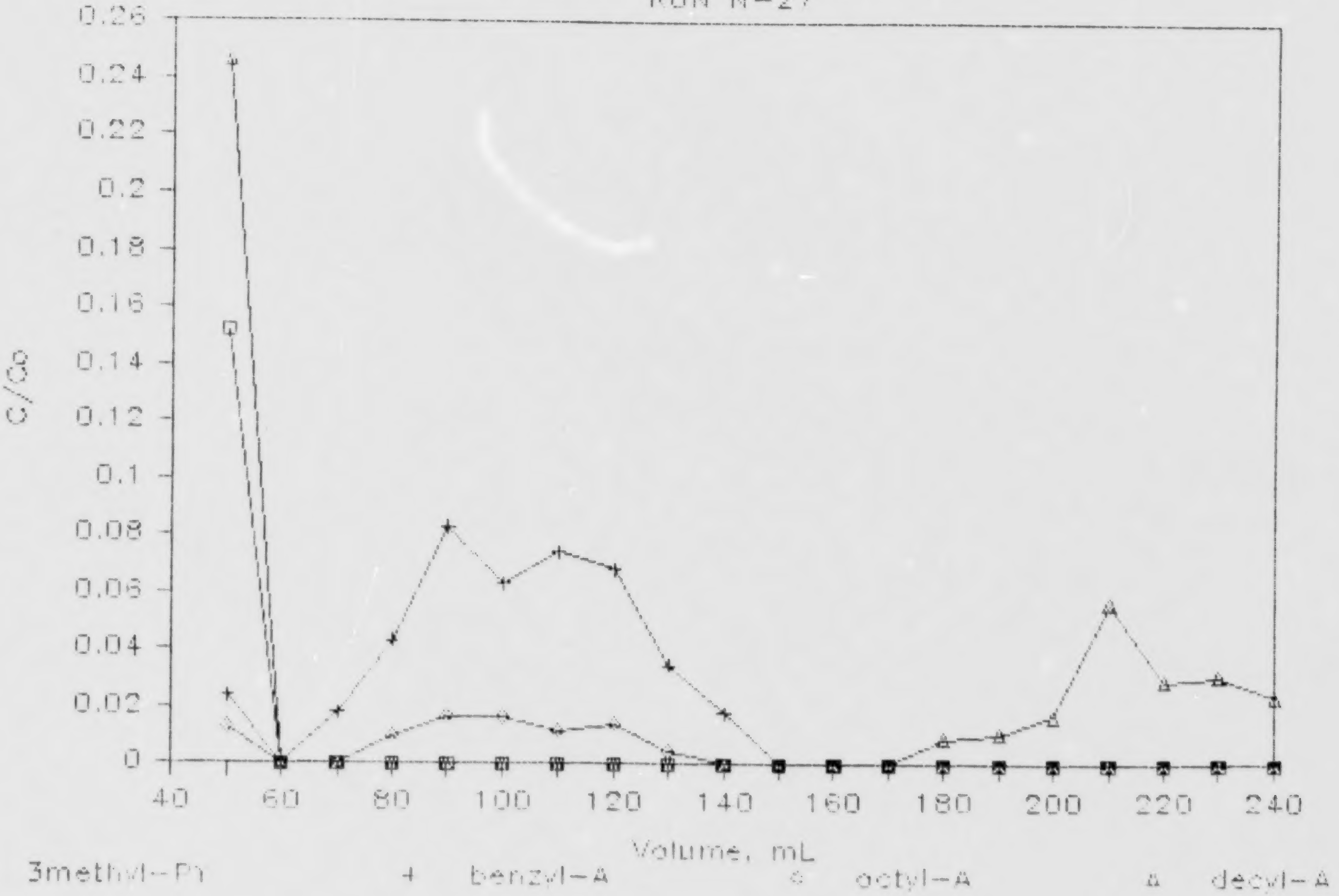
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-27



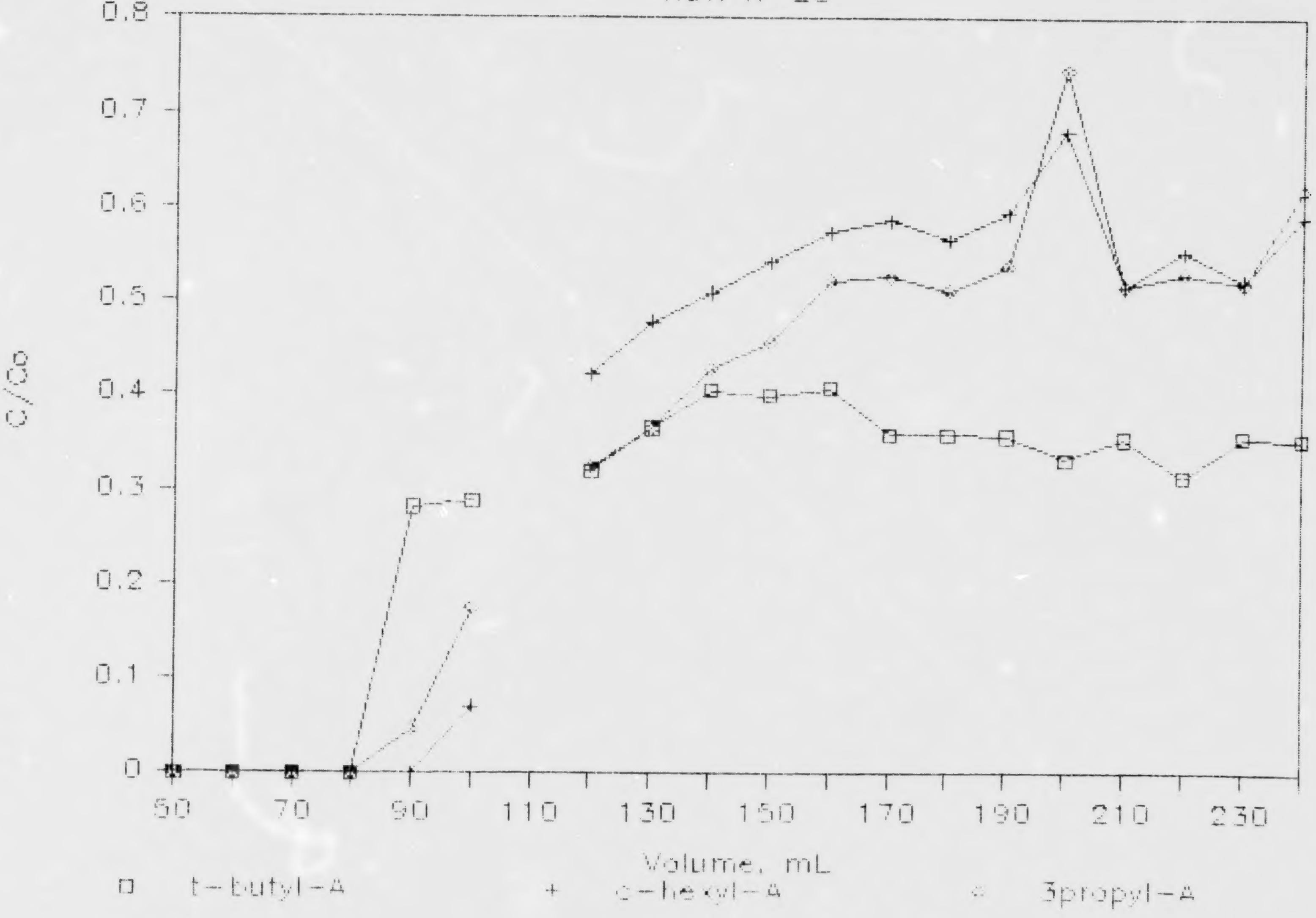
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-27



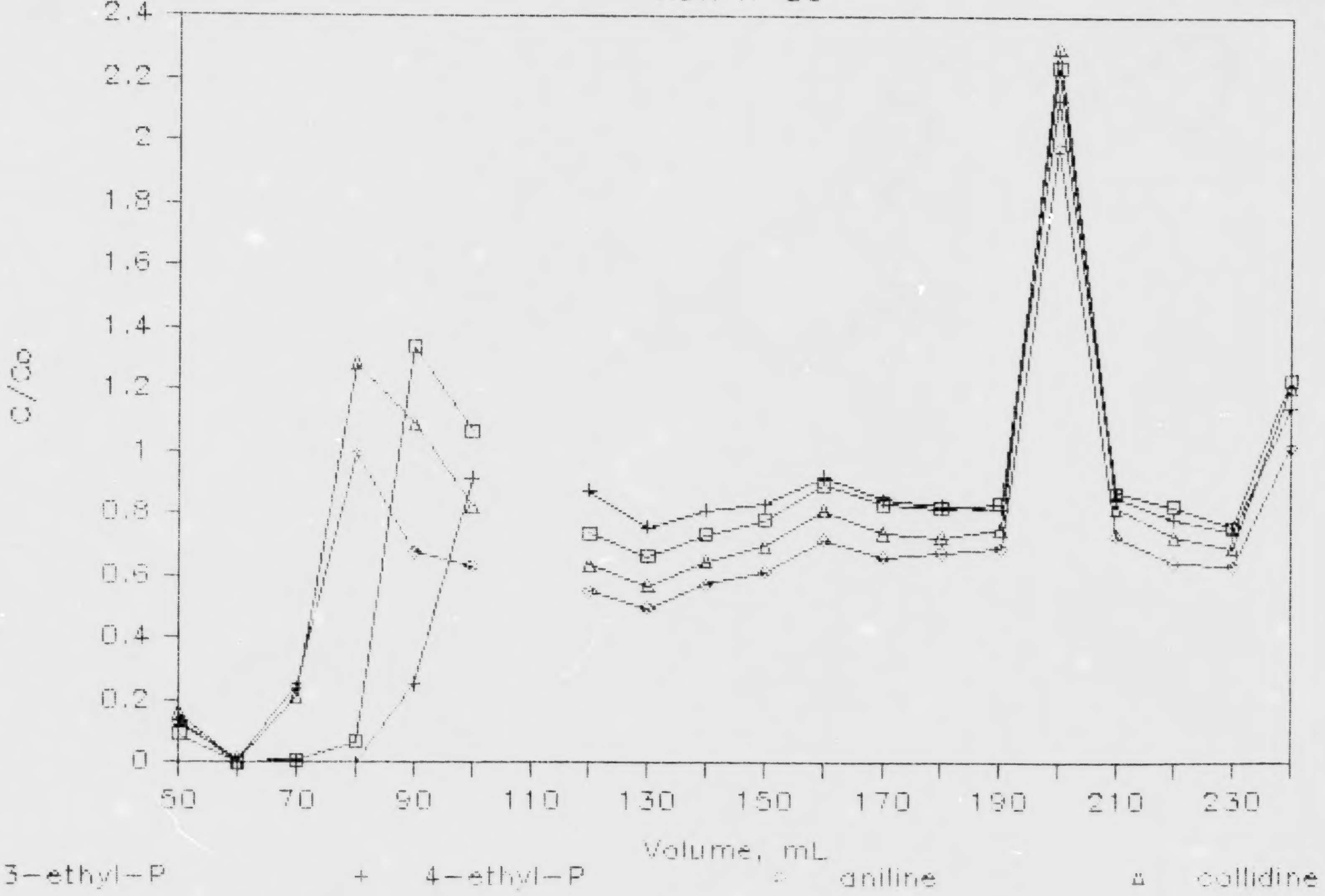
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-28



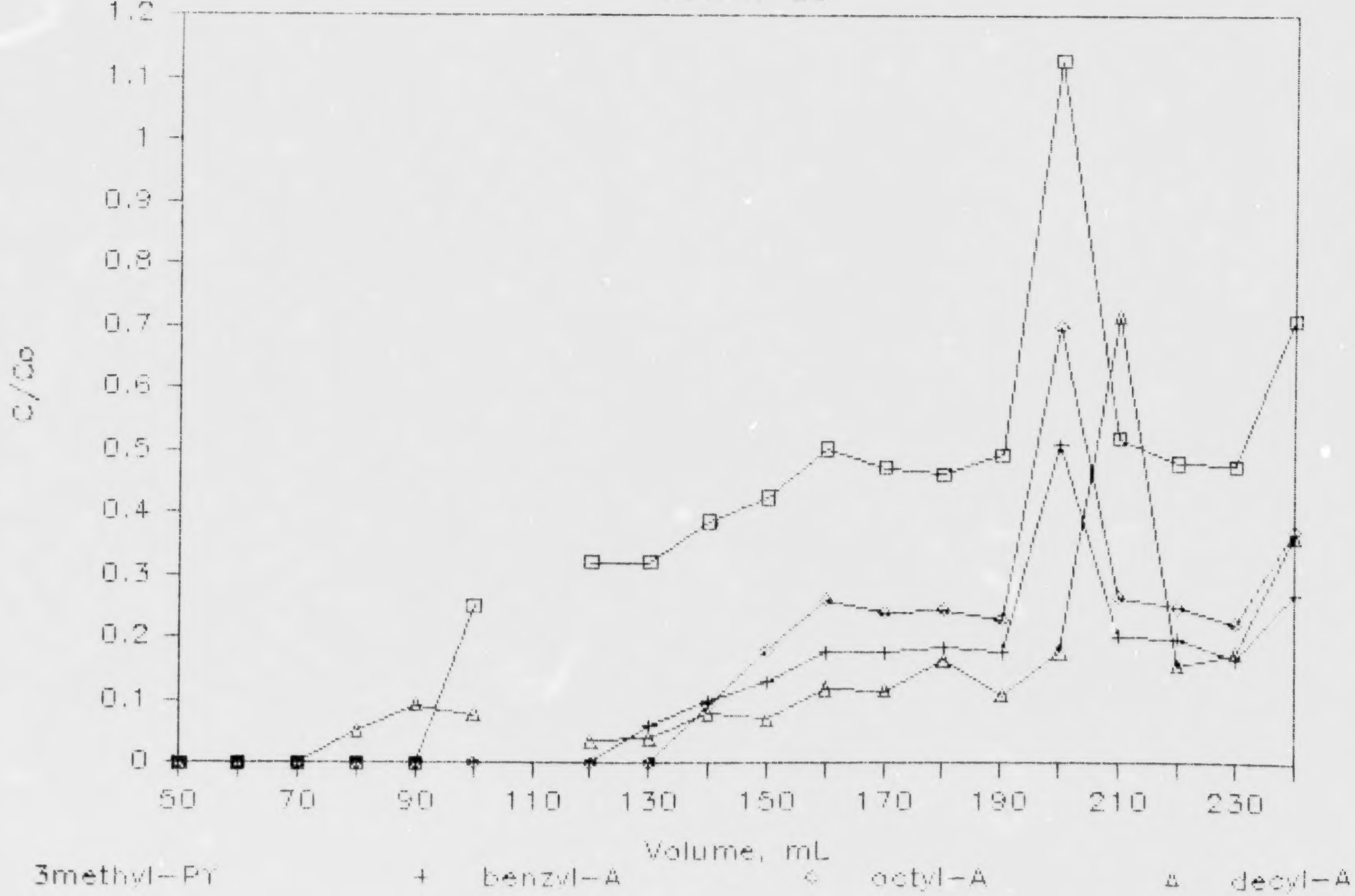
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-28



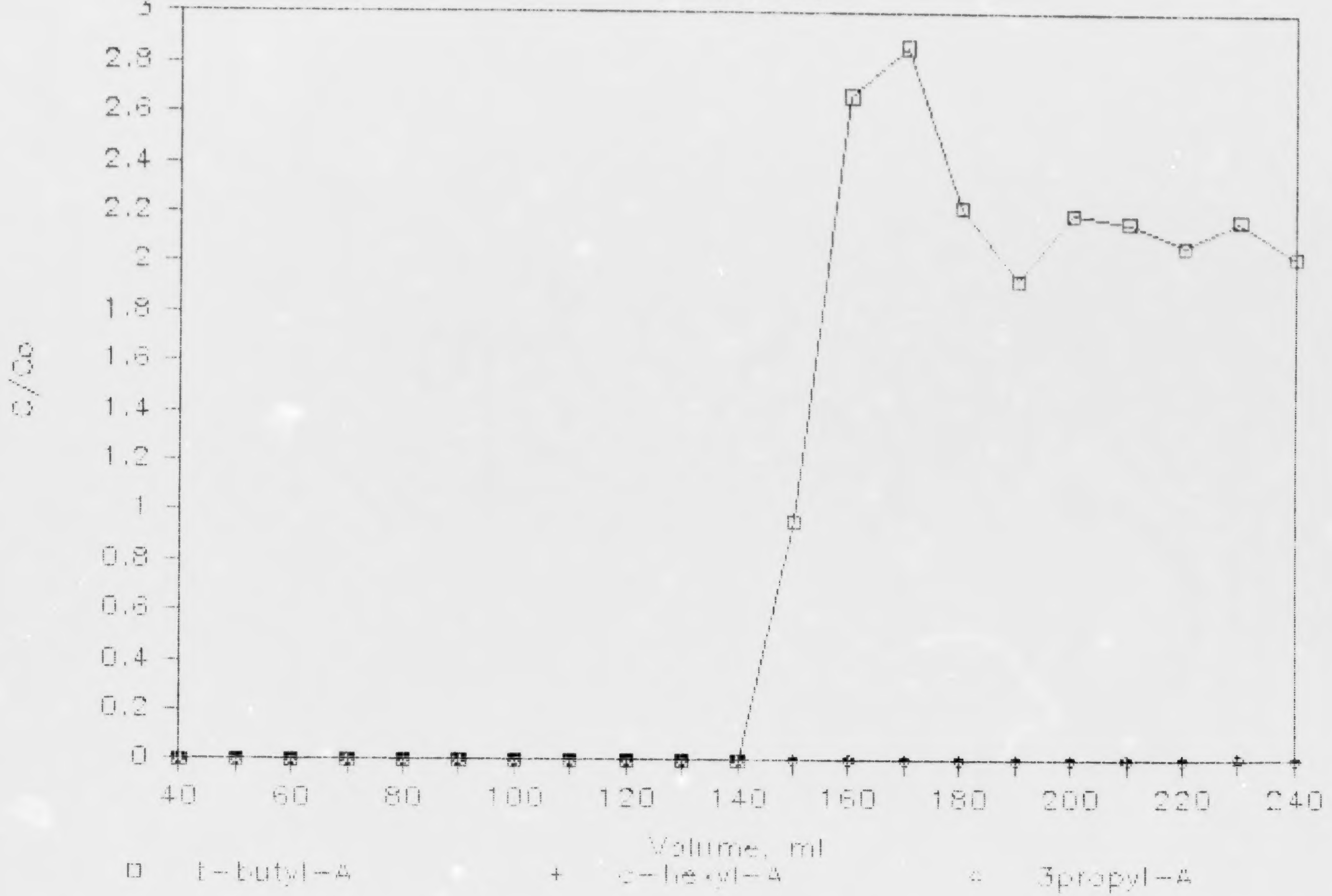
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-28



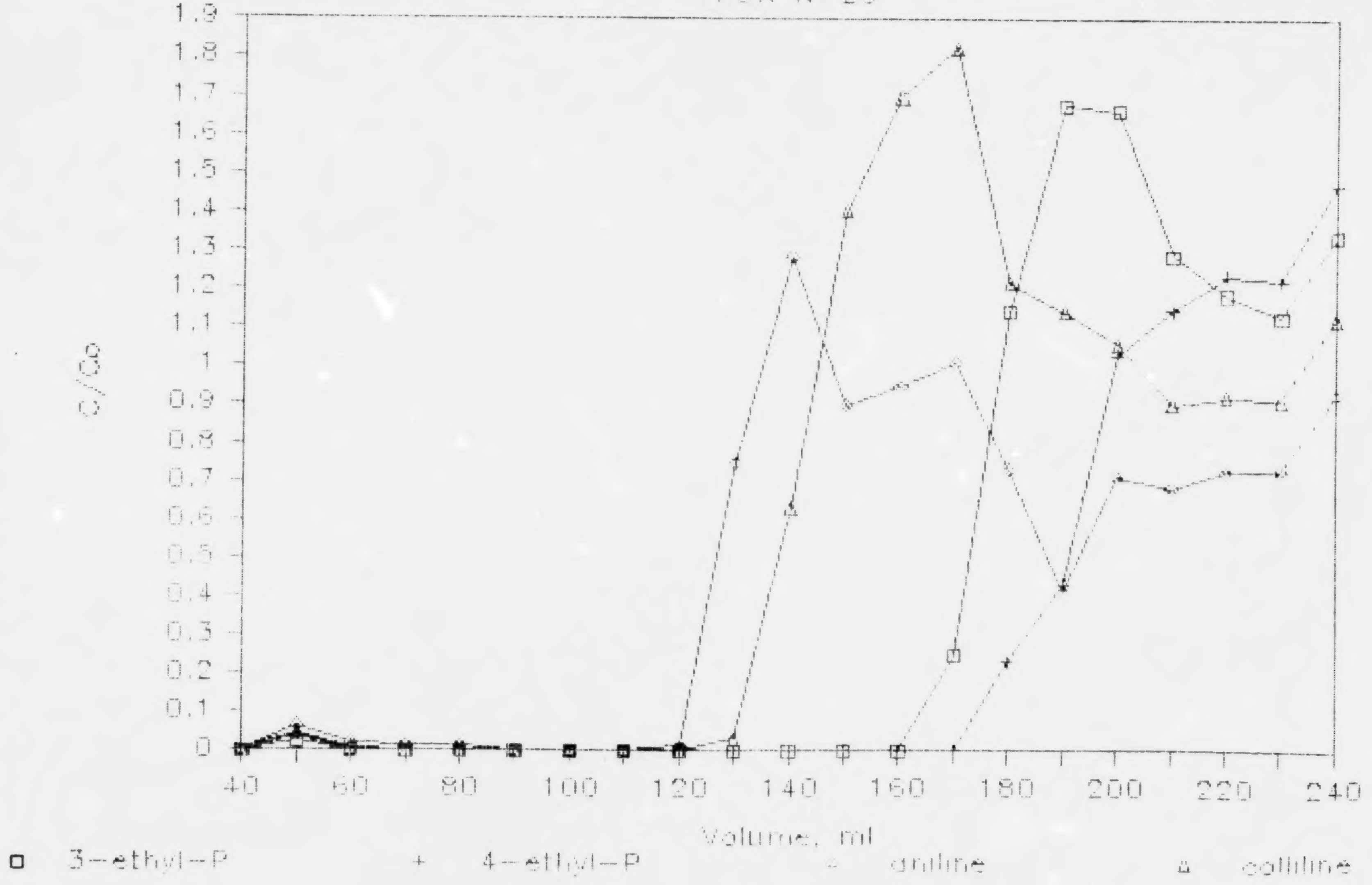
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–29

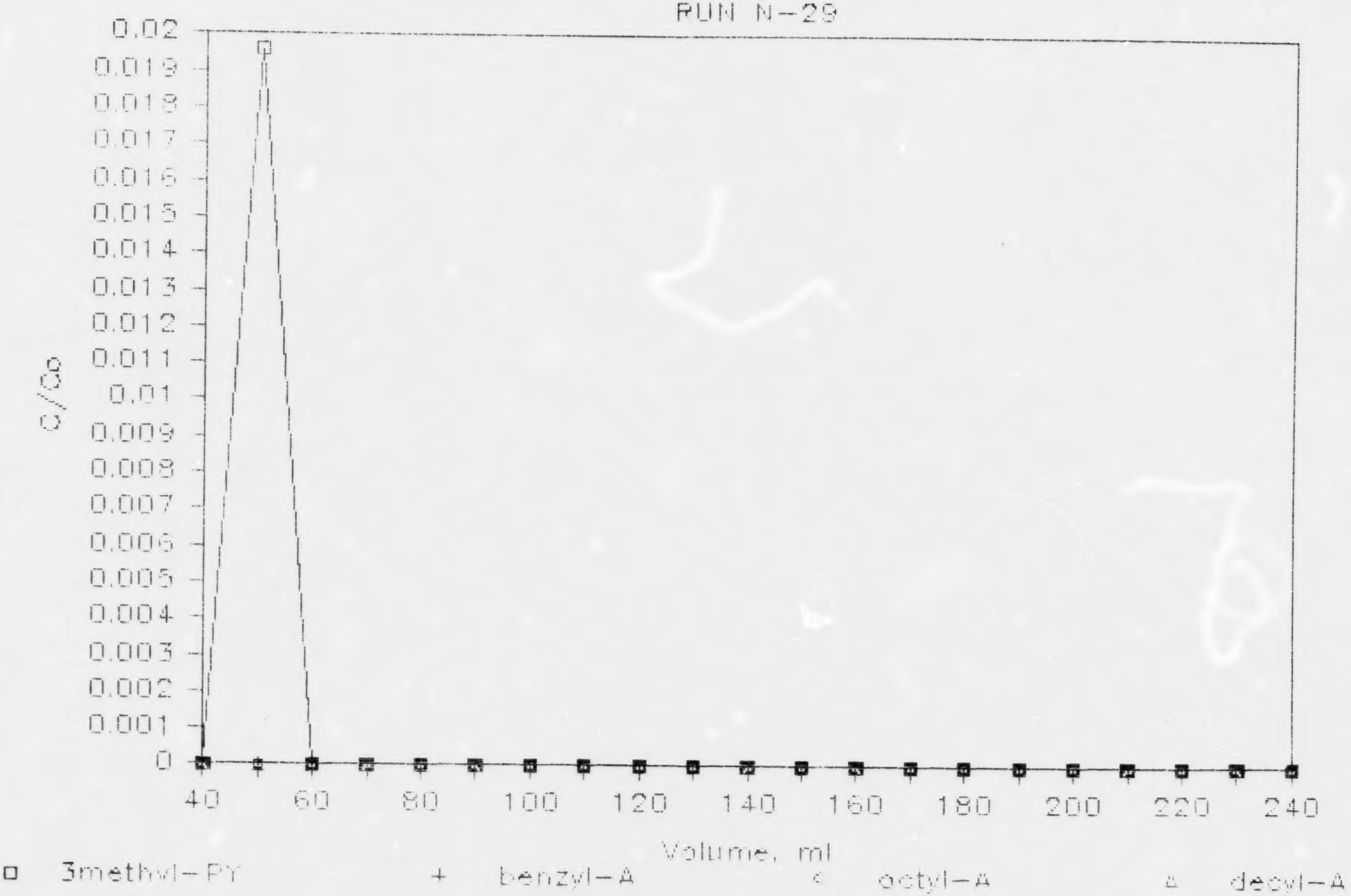


N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–29

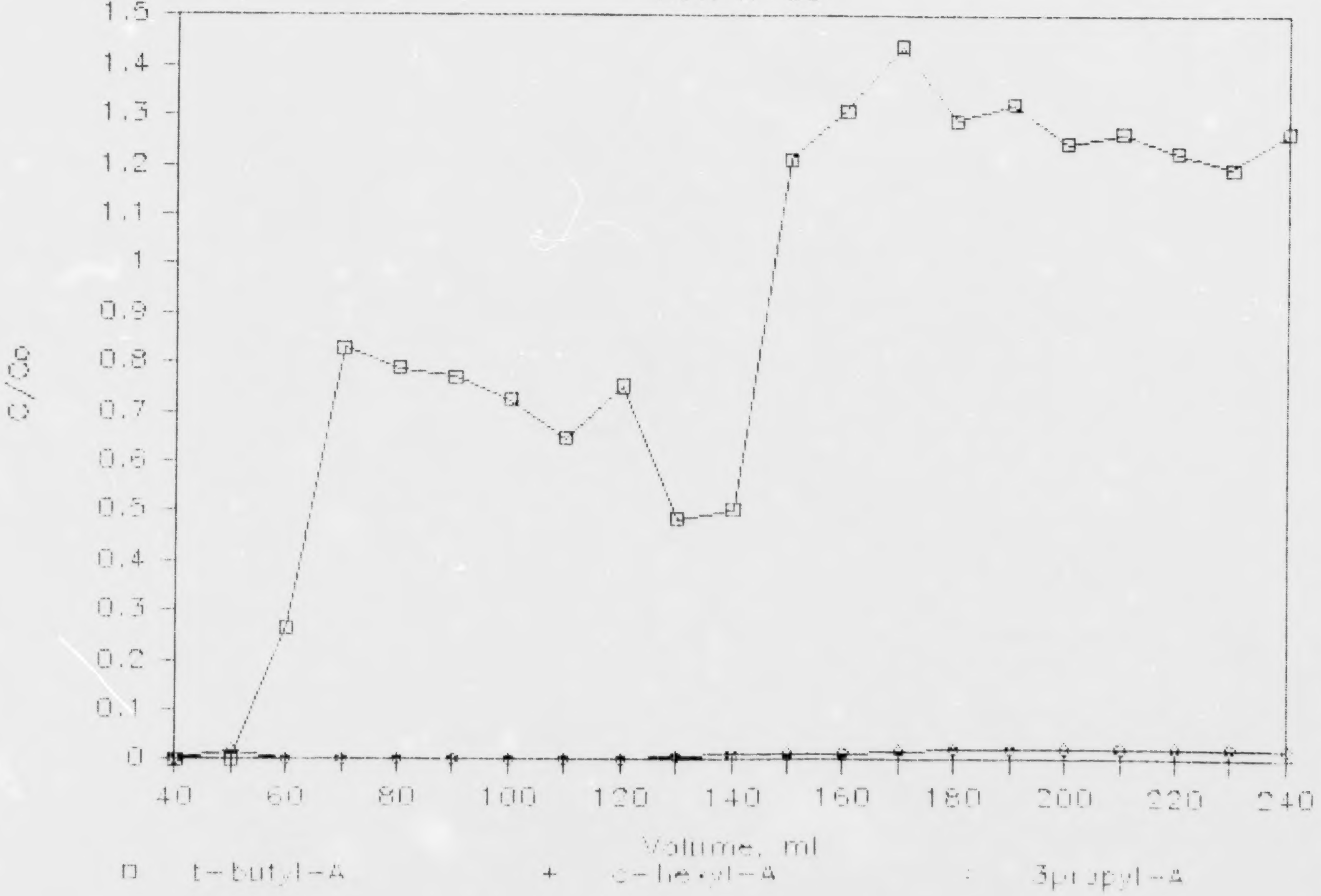


N–COMPOUNDS BREAKTHROUGH CURVES



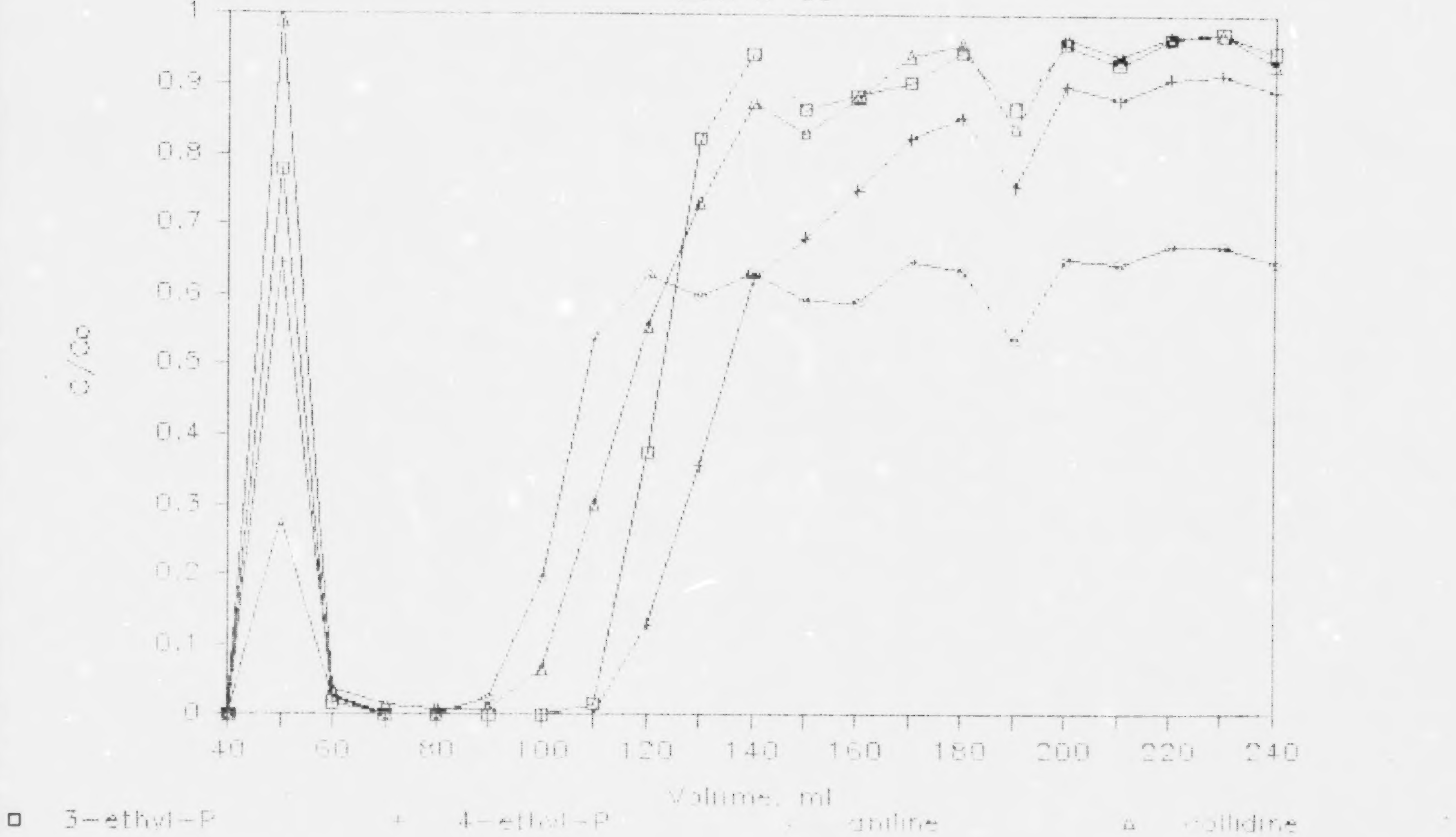
N-COMPOUNDS BREAKTHROUGH CURVES

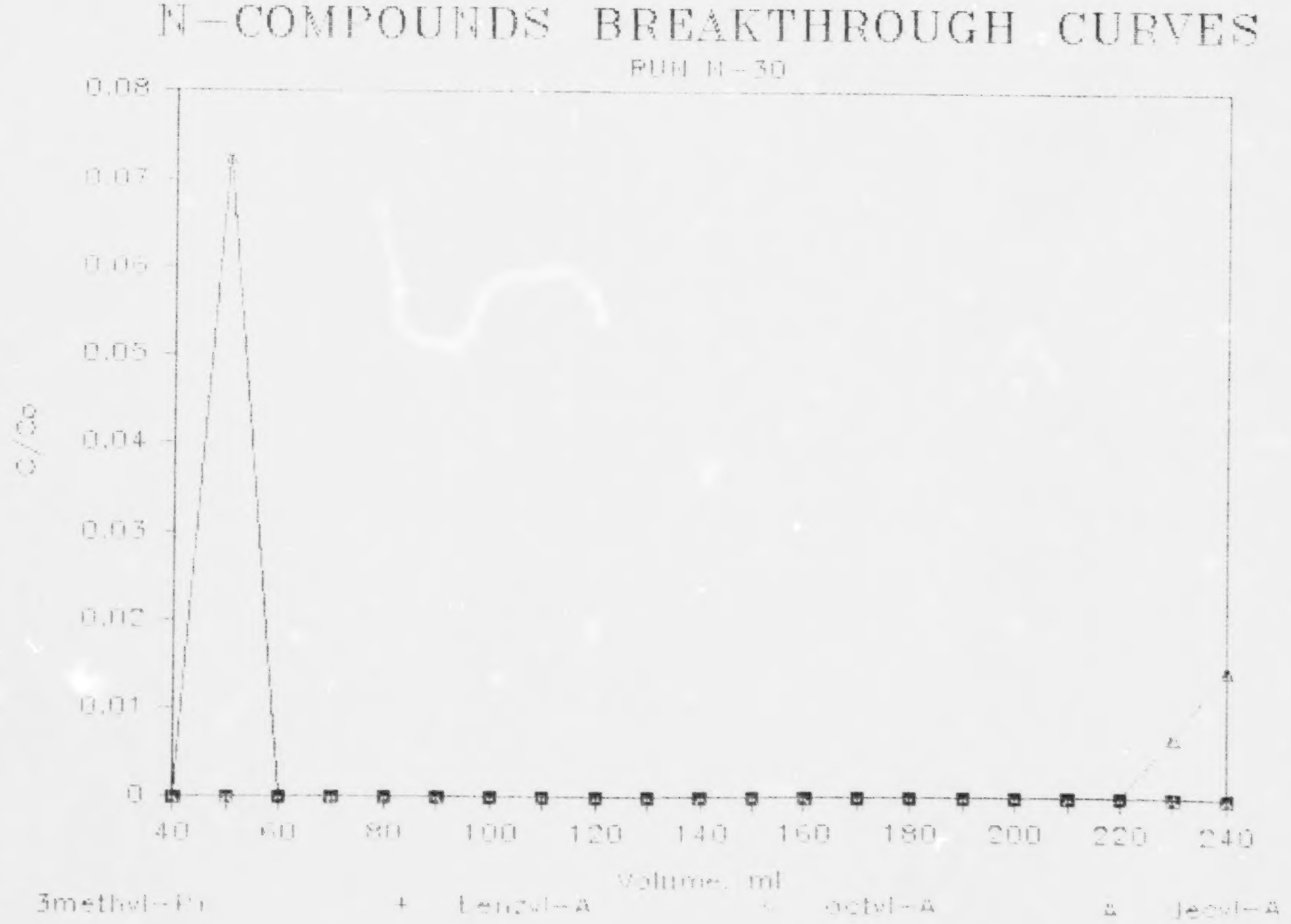
RUN N-30



N-COMPOUNDS BREAKTHROUGH CURVES

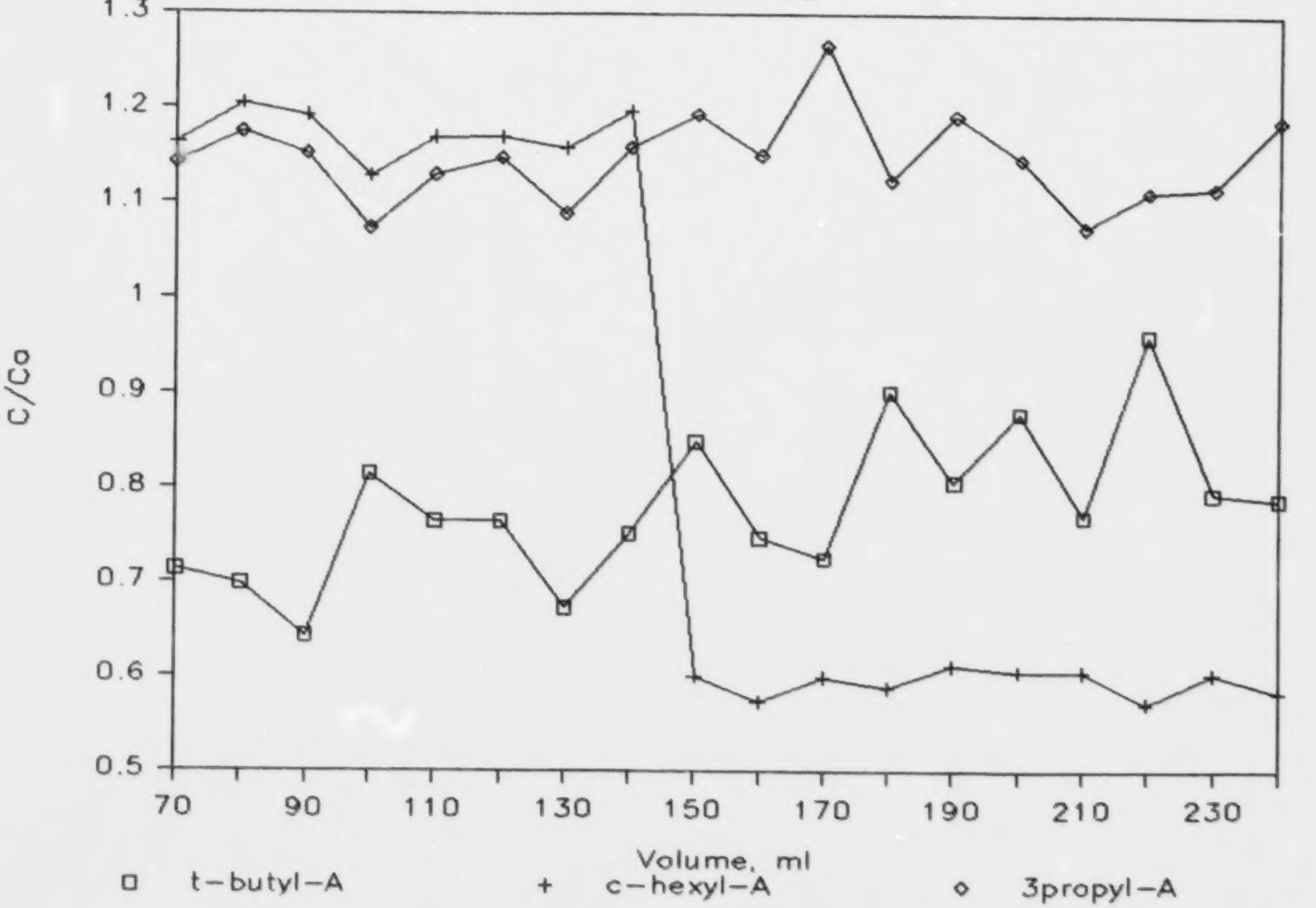
RUN N-30




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-30
C/Co
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
40
60
80
100
120
140
160
180
200
220
240
Volume, ml
□ 3methyl-Py
+ benzyl-A
◇ octyl-A
△ decyl-A

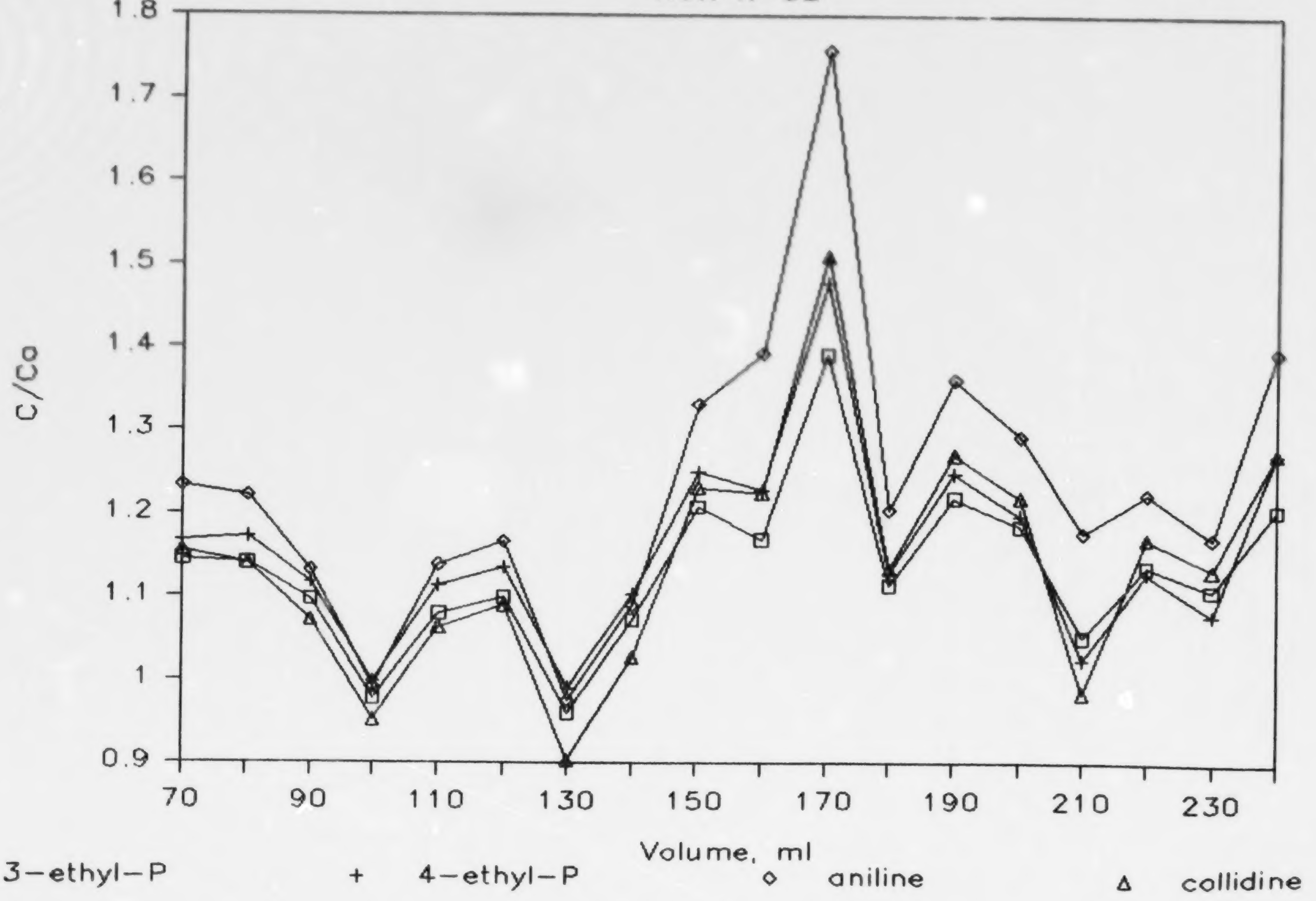
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-32



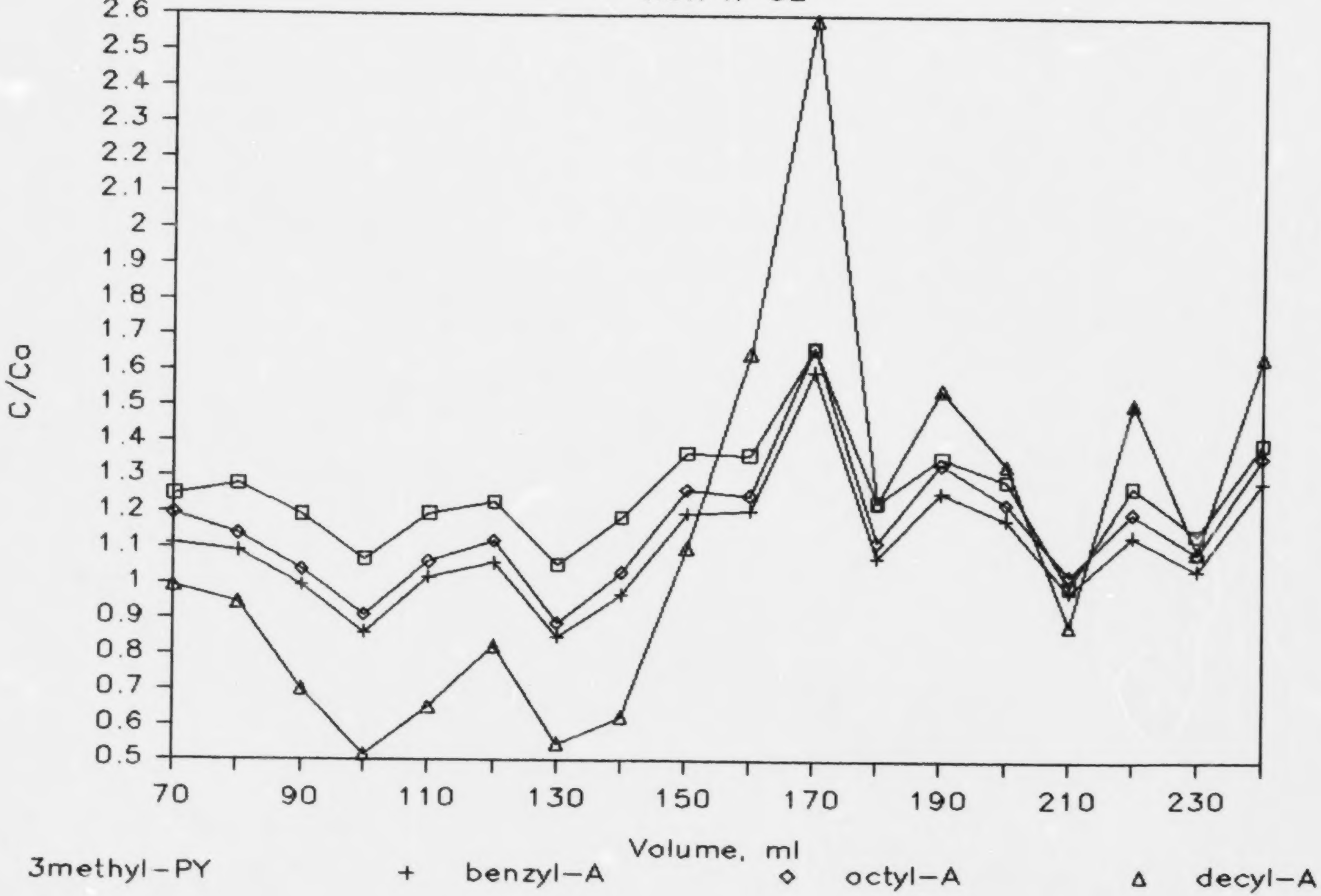
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-32

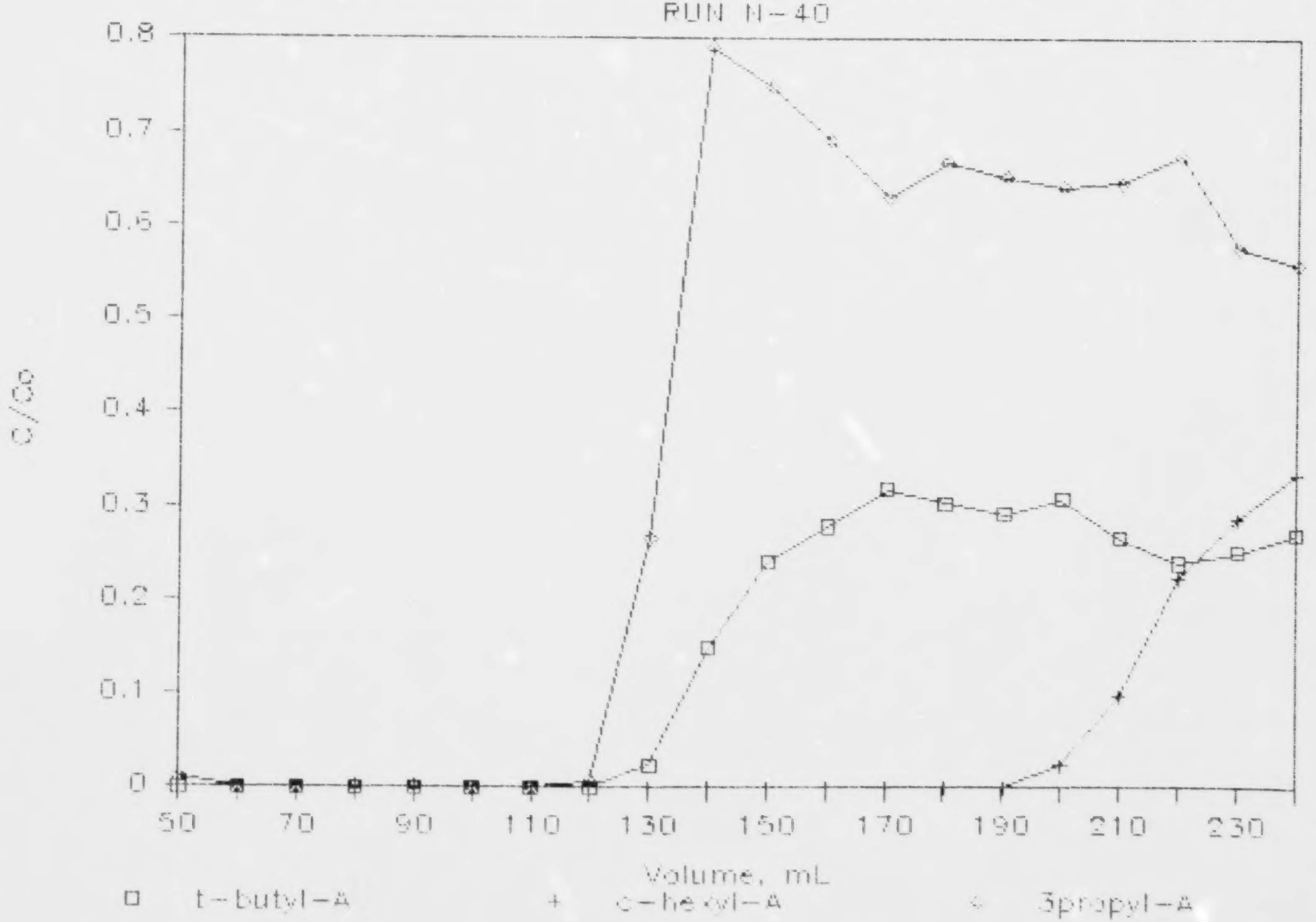


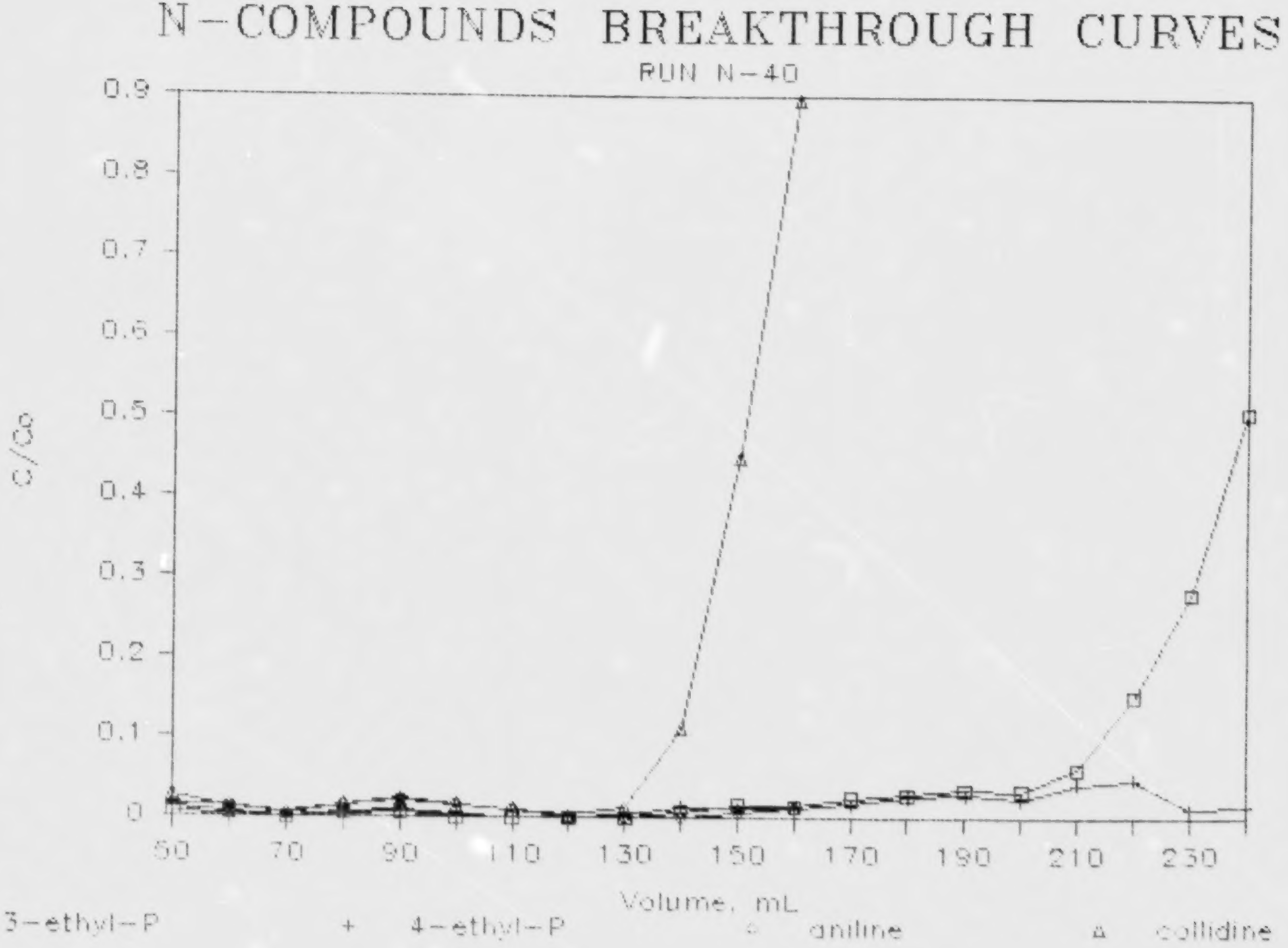
N-COMPOUNDS BREAKTHROUGH CURVES

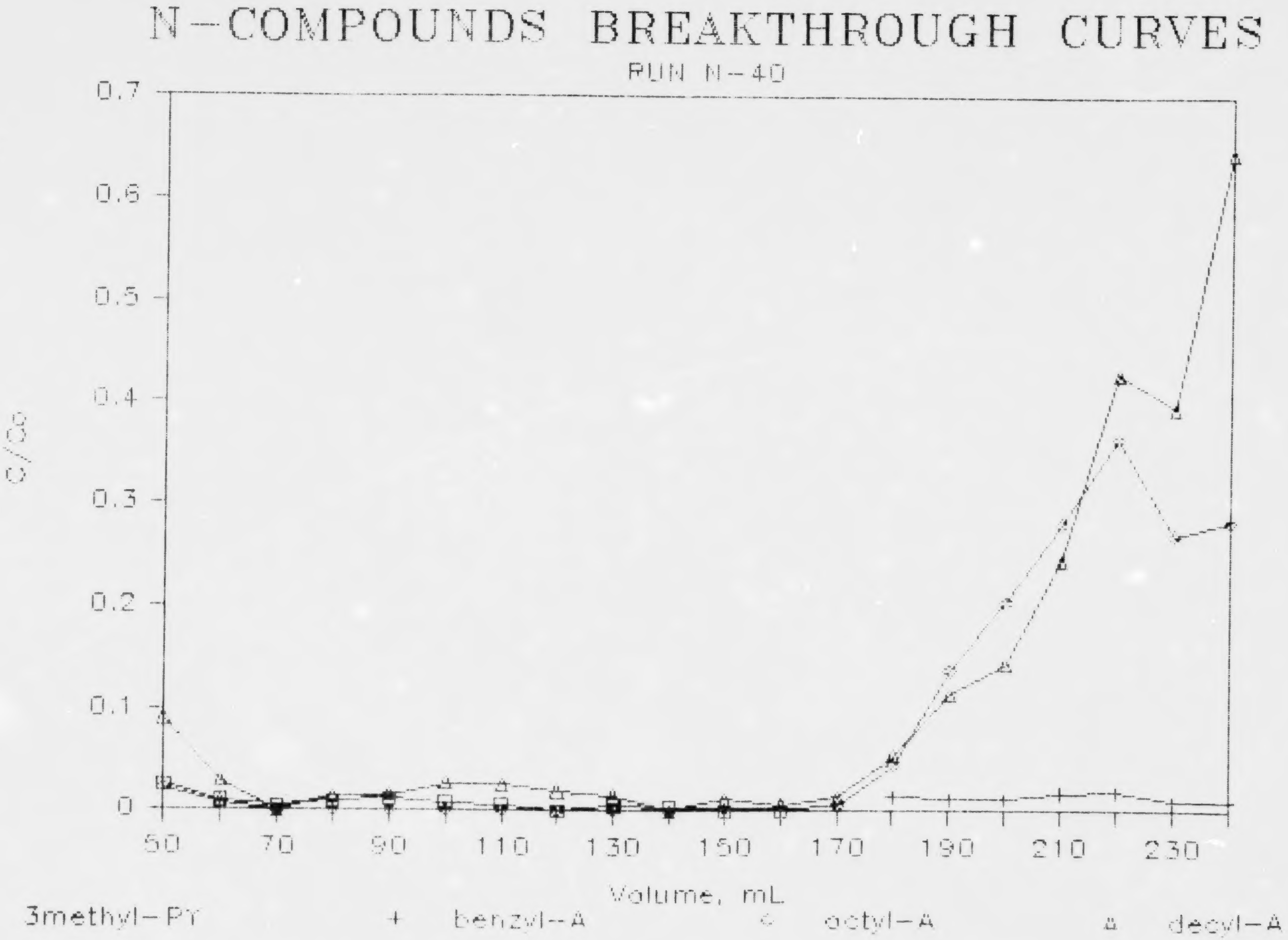
RUN N-32



N–COMPOUNDS BREAKTHROUGH CURVES

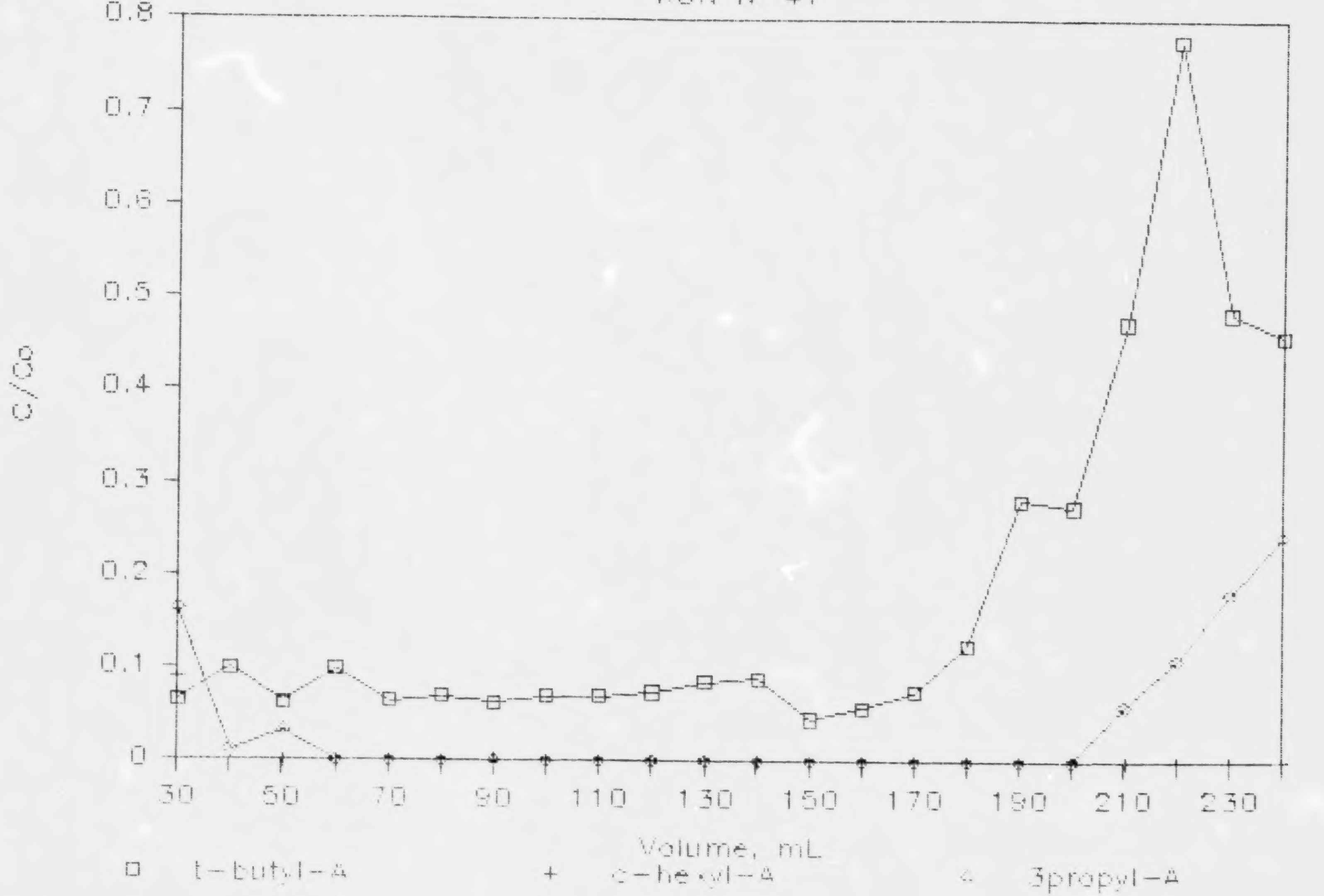



N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-40
C/Co
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
70
90
110
130
150
170
190
210
230
Volume, mL
3-ethyl-P
+ 4-ethyl-P
◇ aniline
△ collidine


N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-40
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
C/Co
50
70
90
110
130
150
170
190
210
230
Volume, mL
3methyl-PY
+ benzyl--A
◇ octyl-A
△ decyl-A

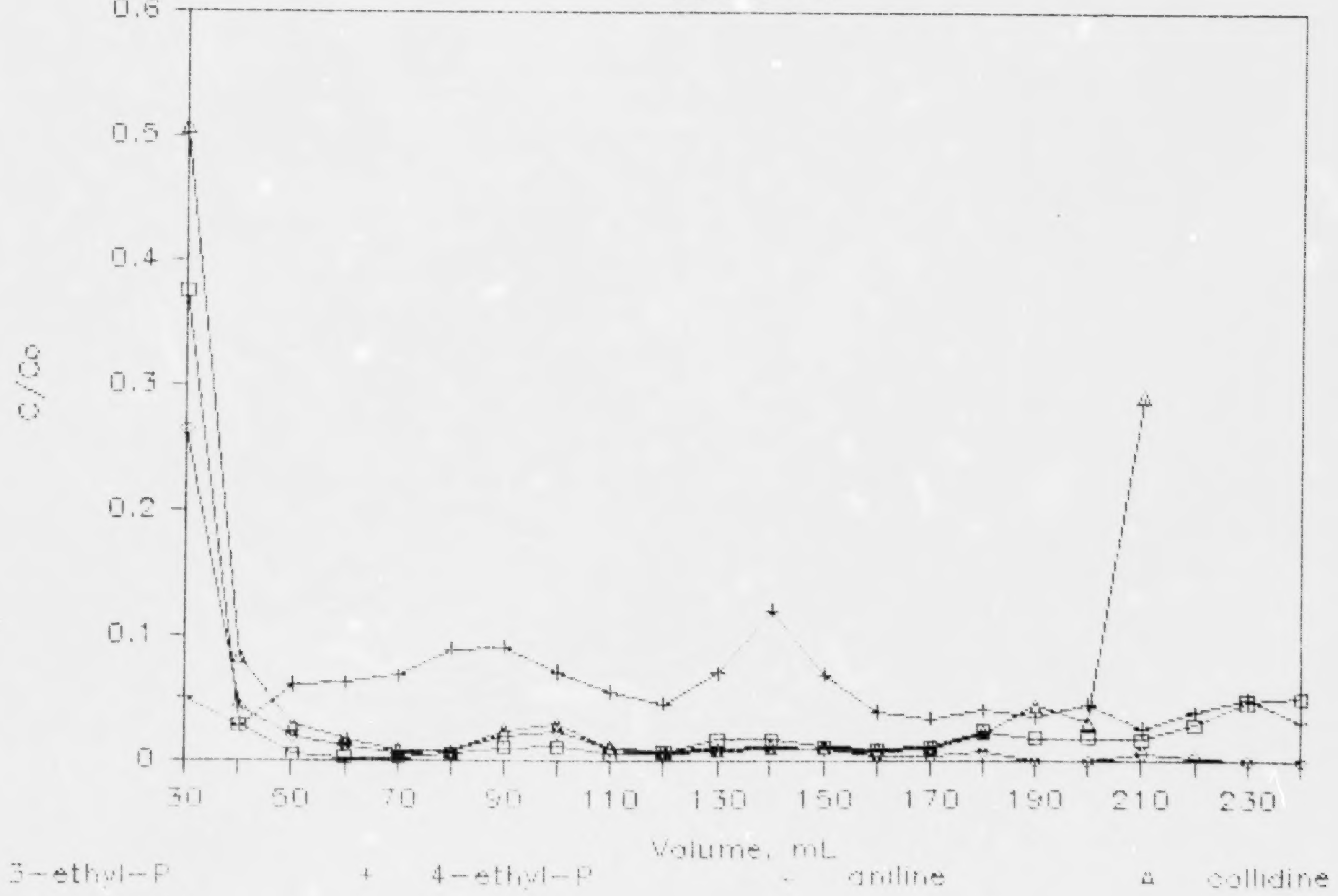
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N—41



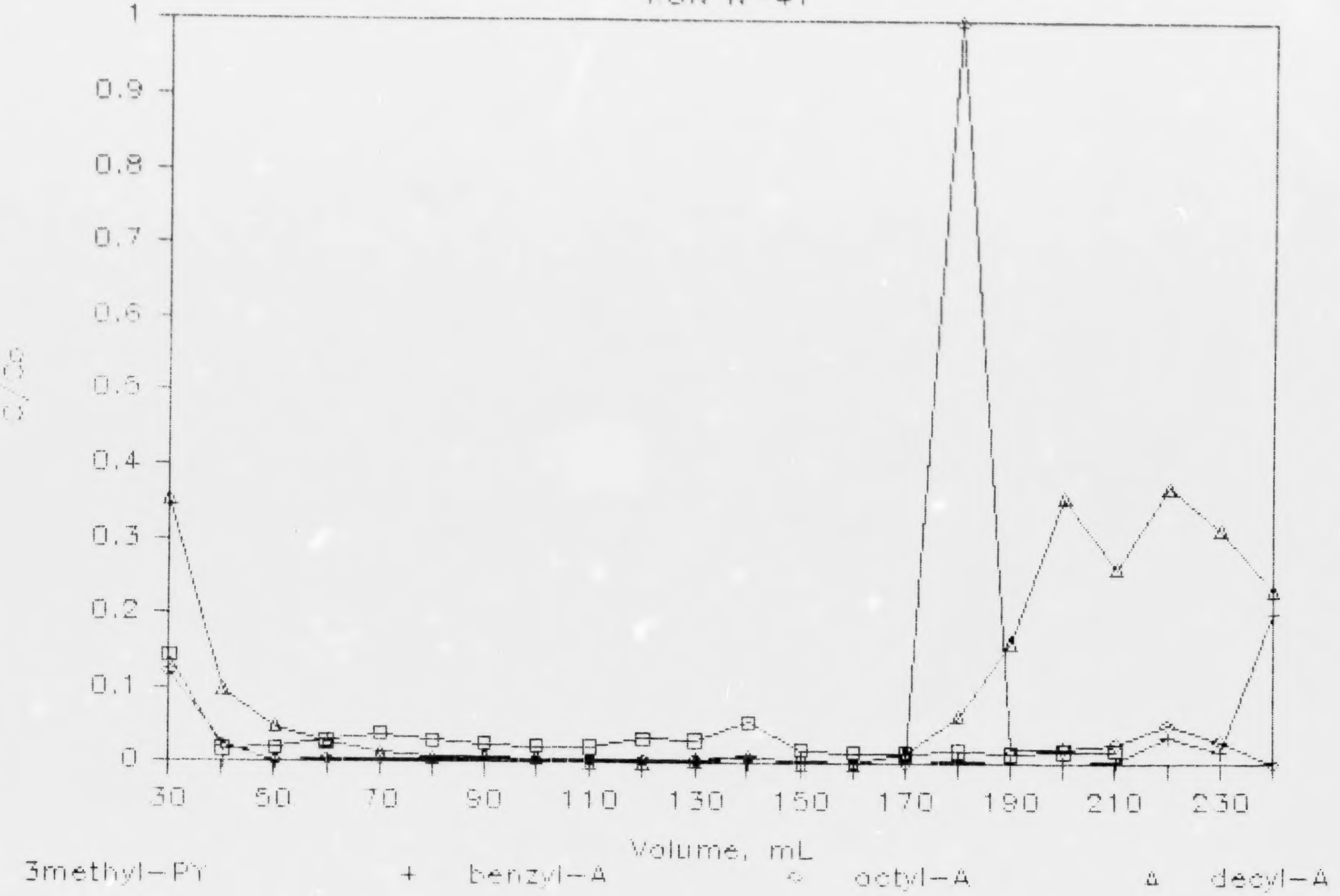
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-41



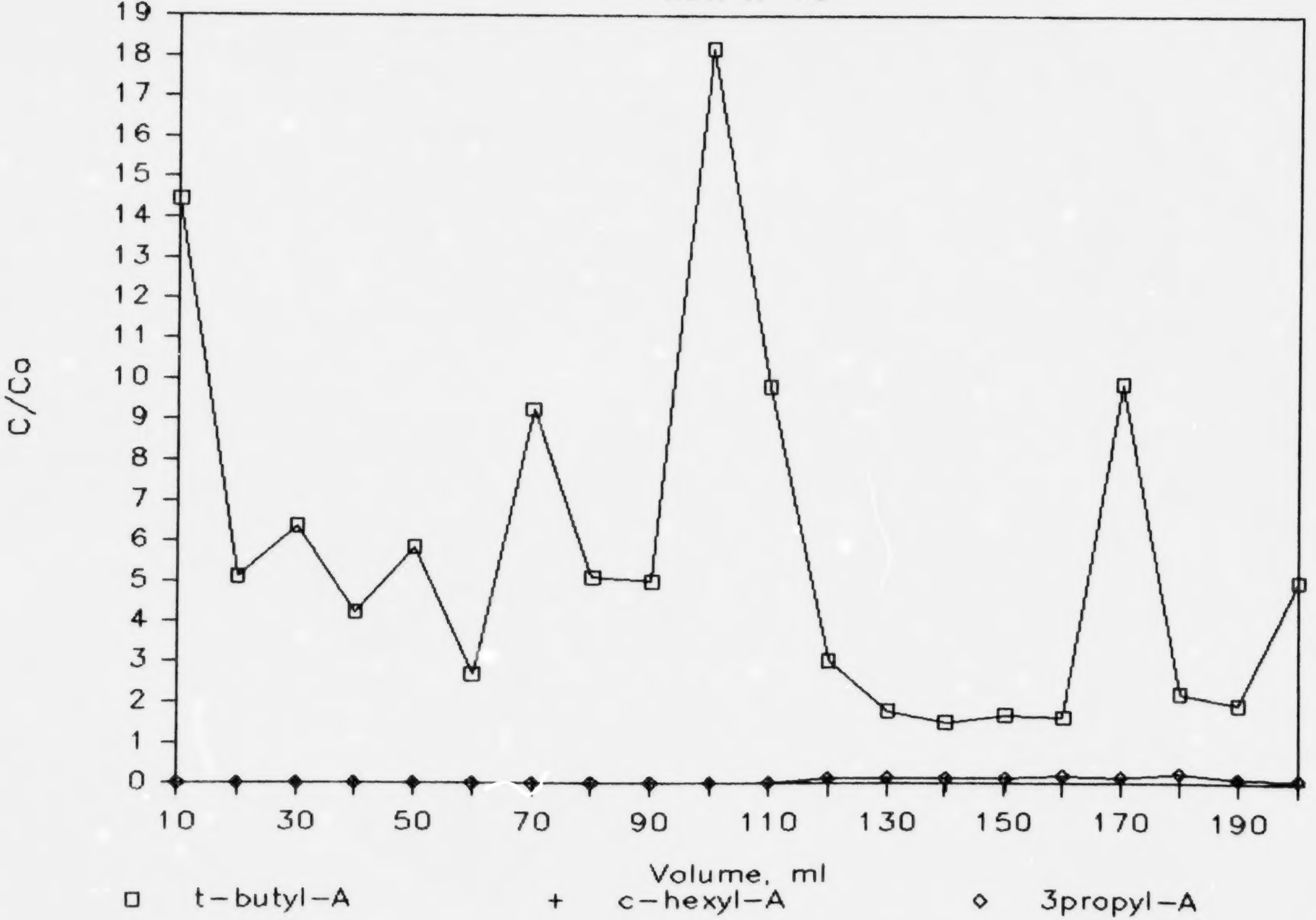
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-41



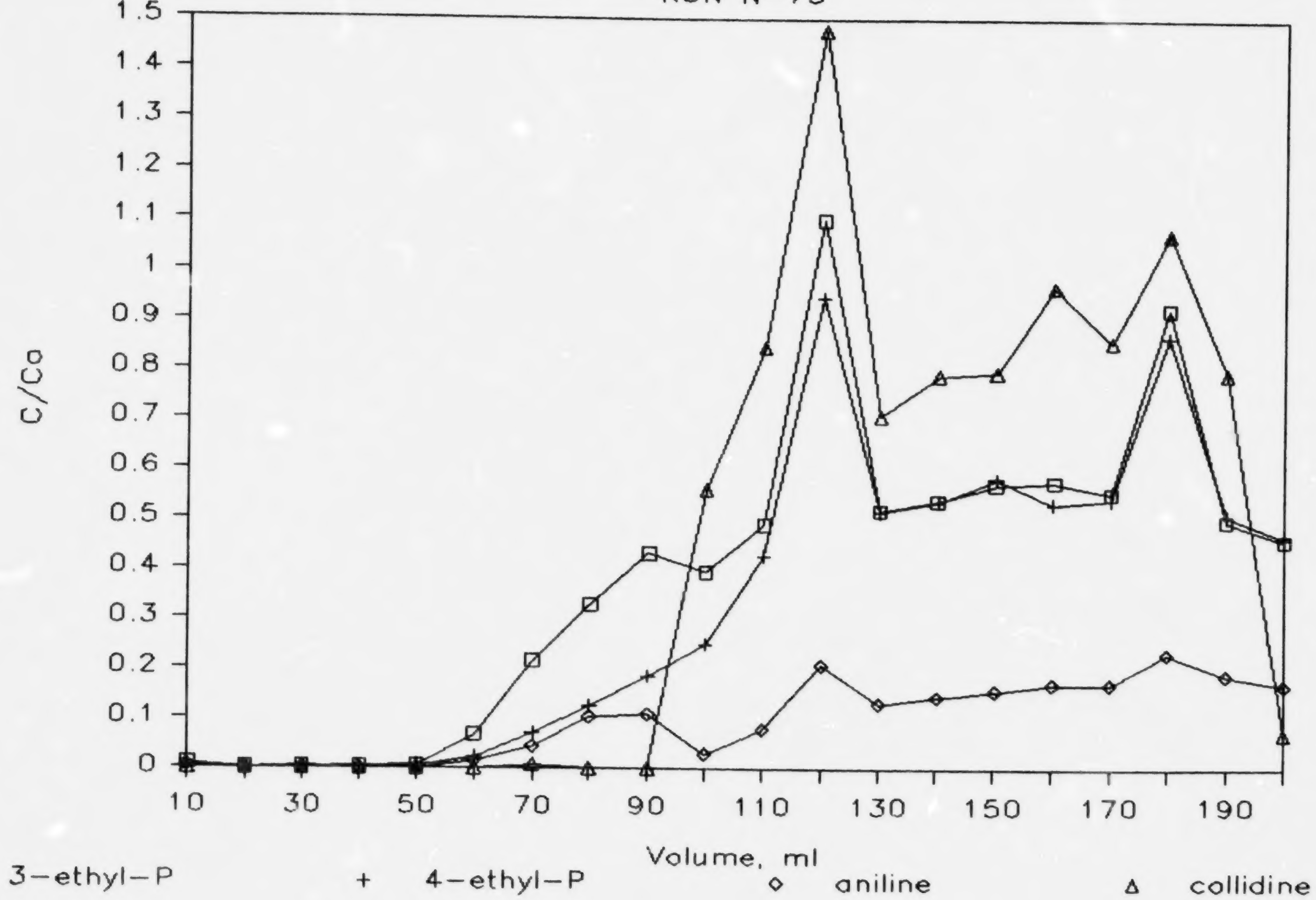
N-COMPOUNDS BREAKTHROUGH CURVES

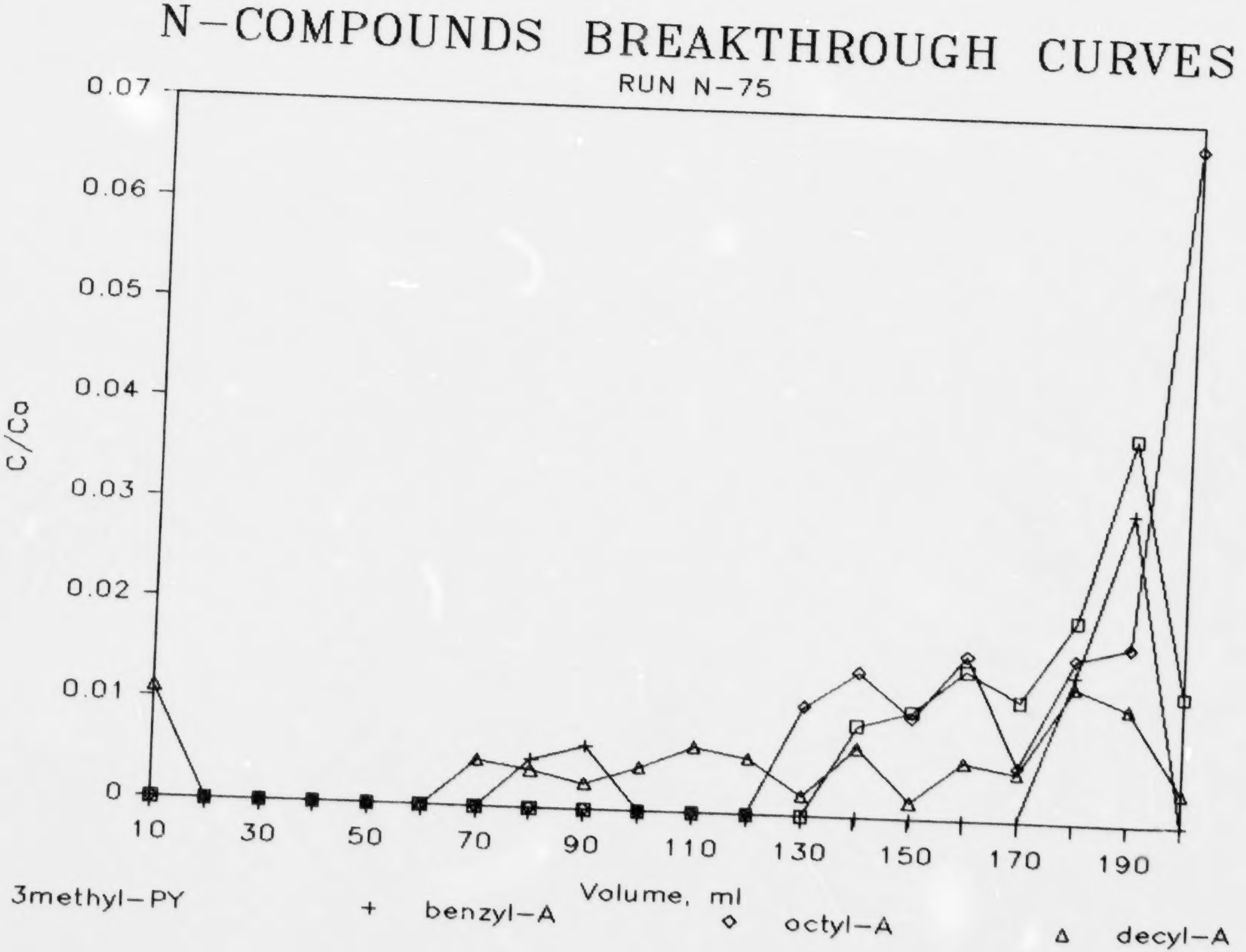
RUN N-75



N-COMPOUNDS BREAKTHROUGH CURVES

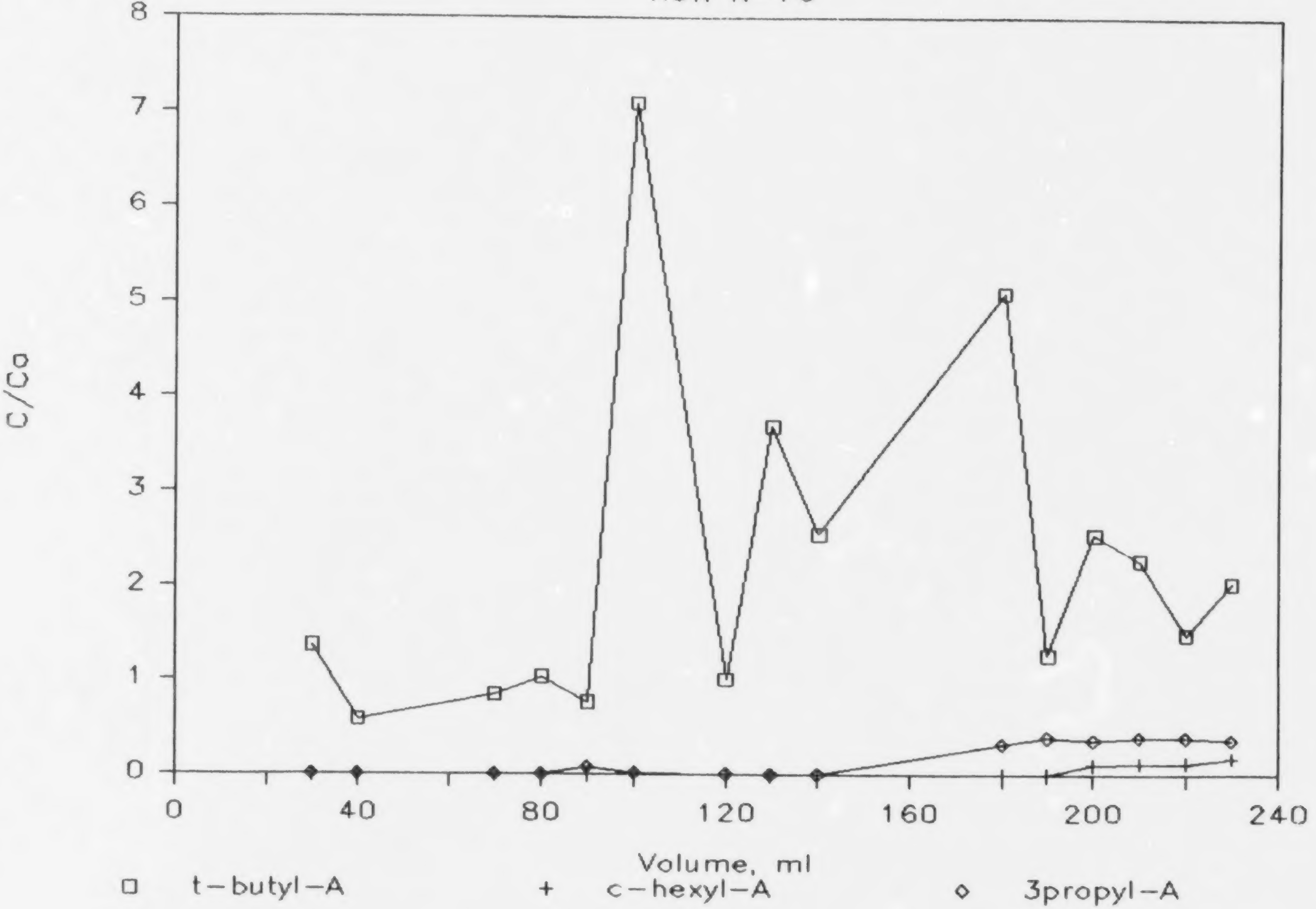
RUN N-75




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-75
C/Co
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
10
30
50
70
90
110
130
150
170
190
Volume, ml
3methyl-PY
+ benzyl-A
◇ octyl-A
Δ decyl-A

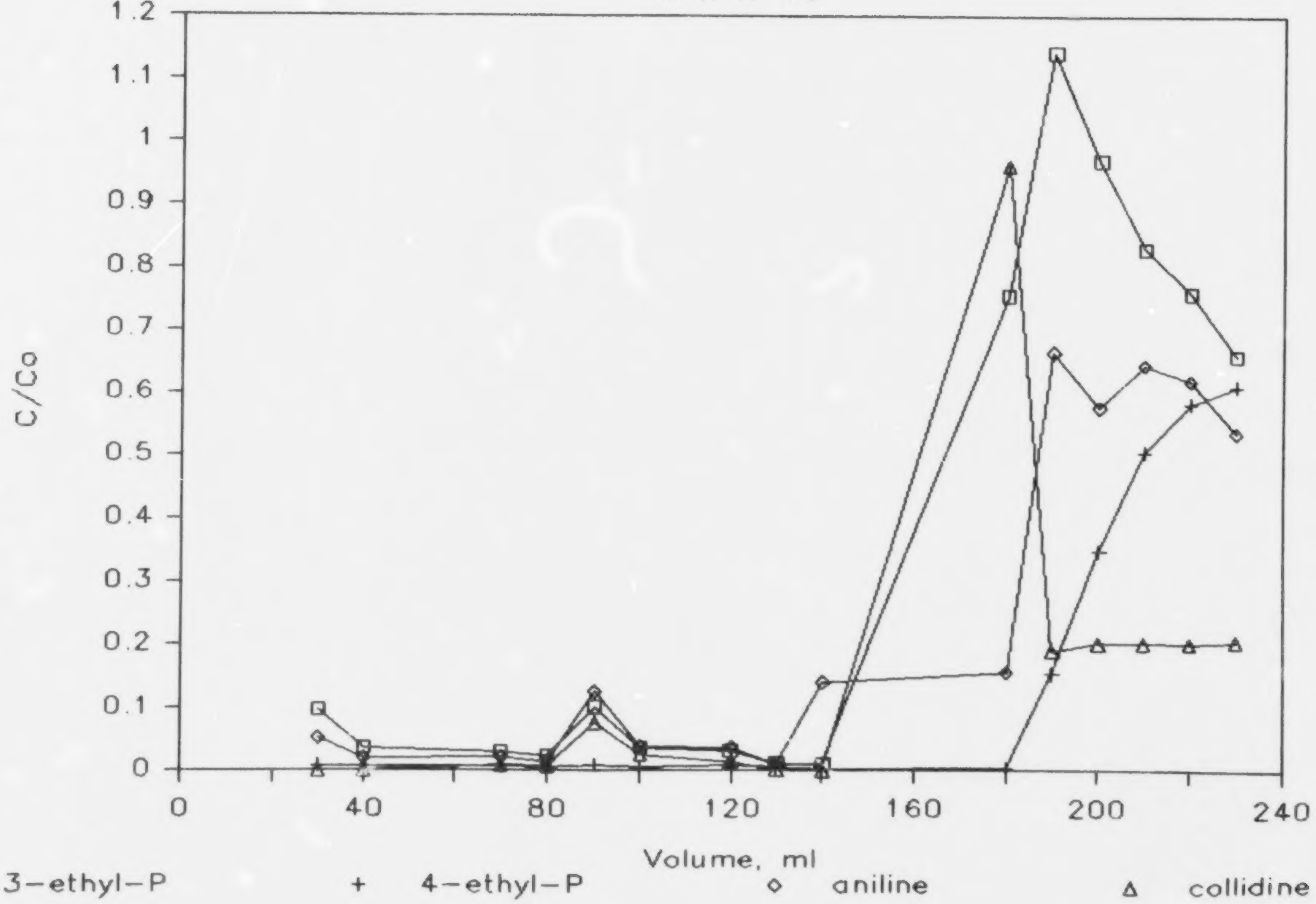
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-76



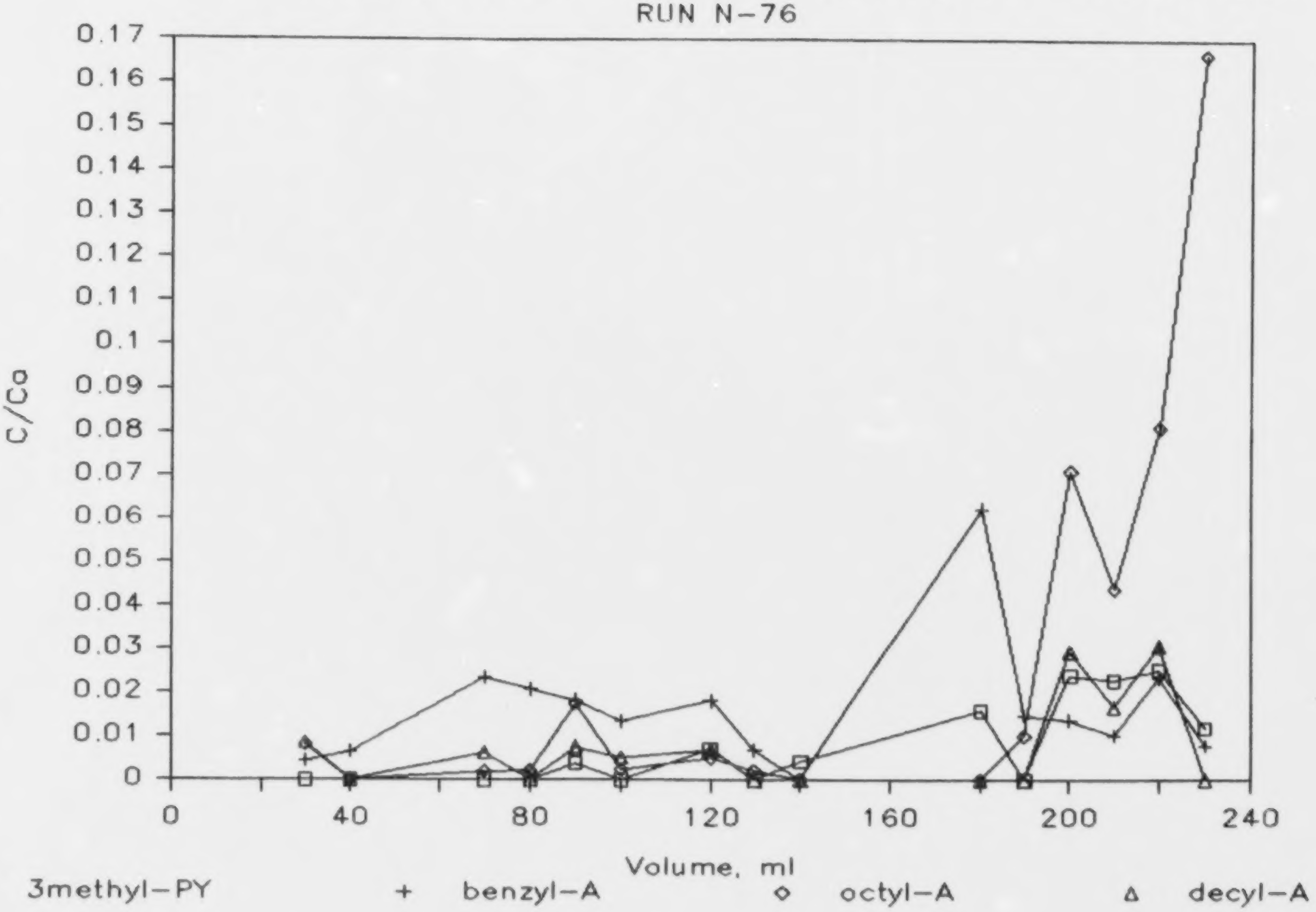
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-76



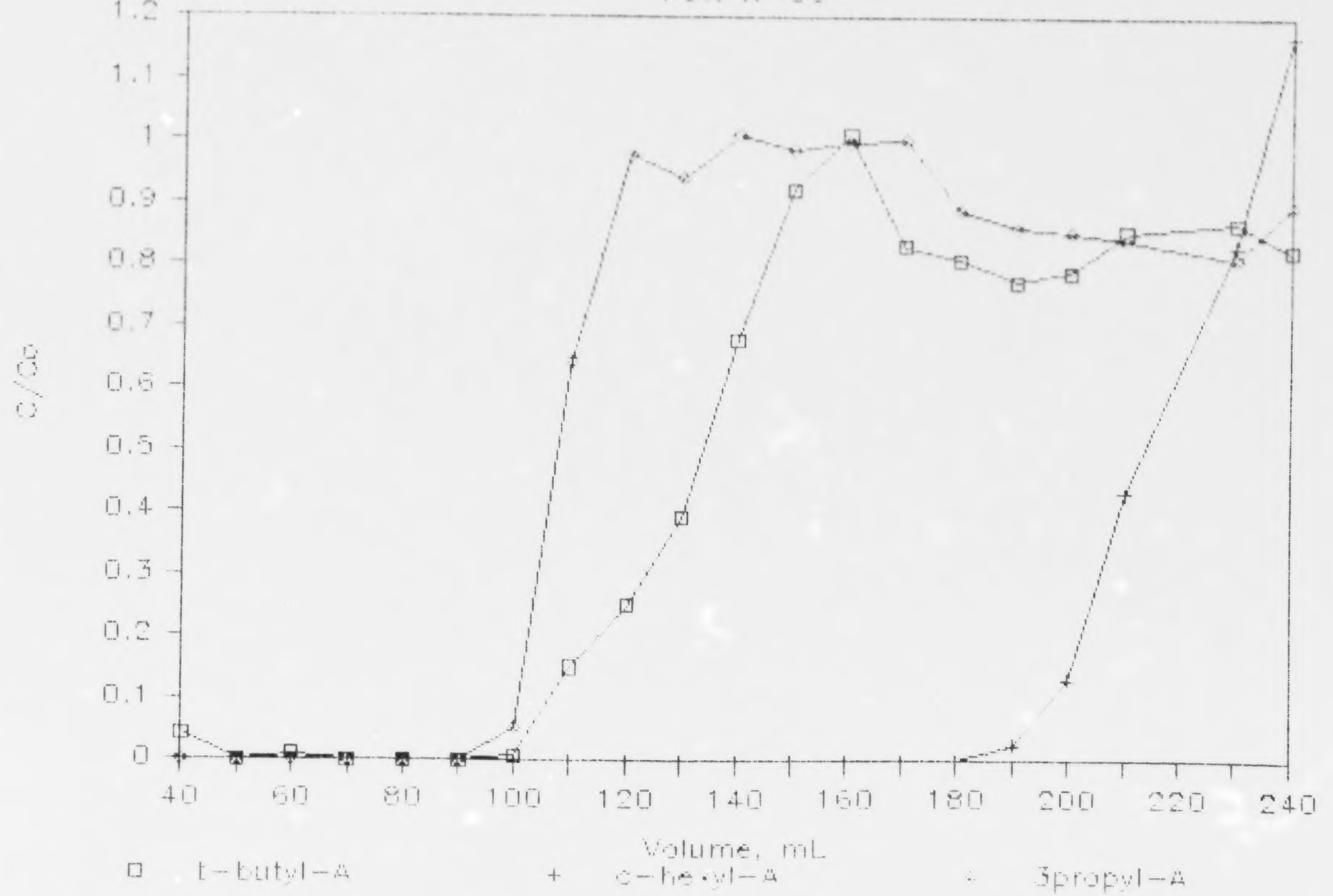
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-76



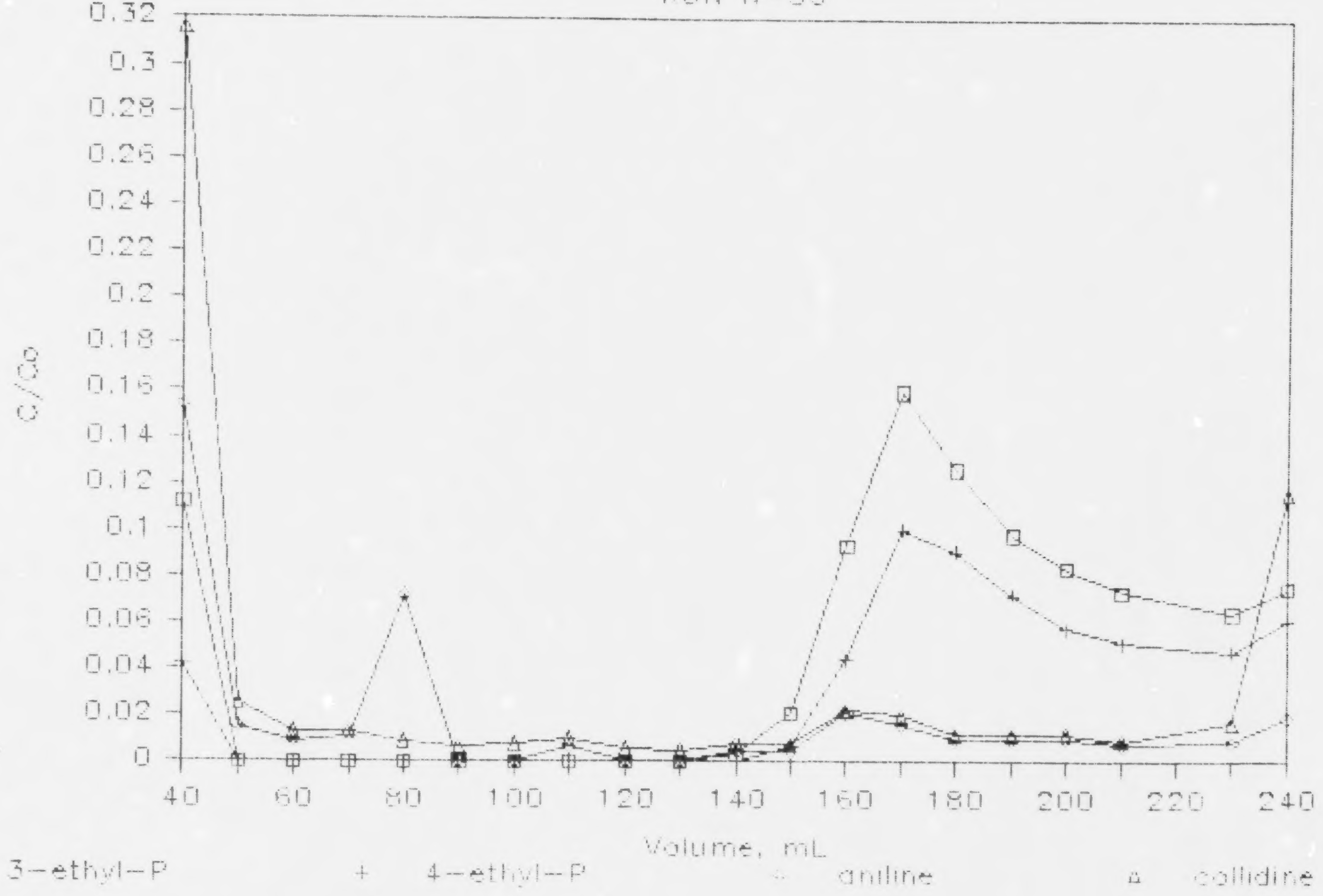
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-36



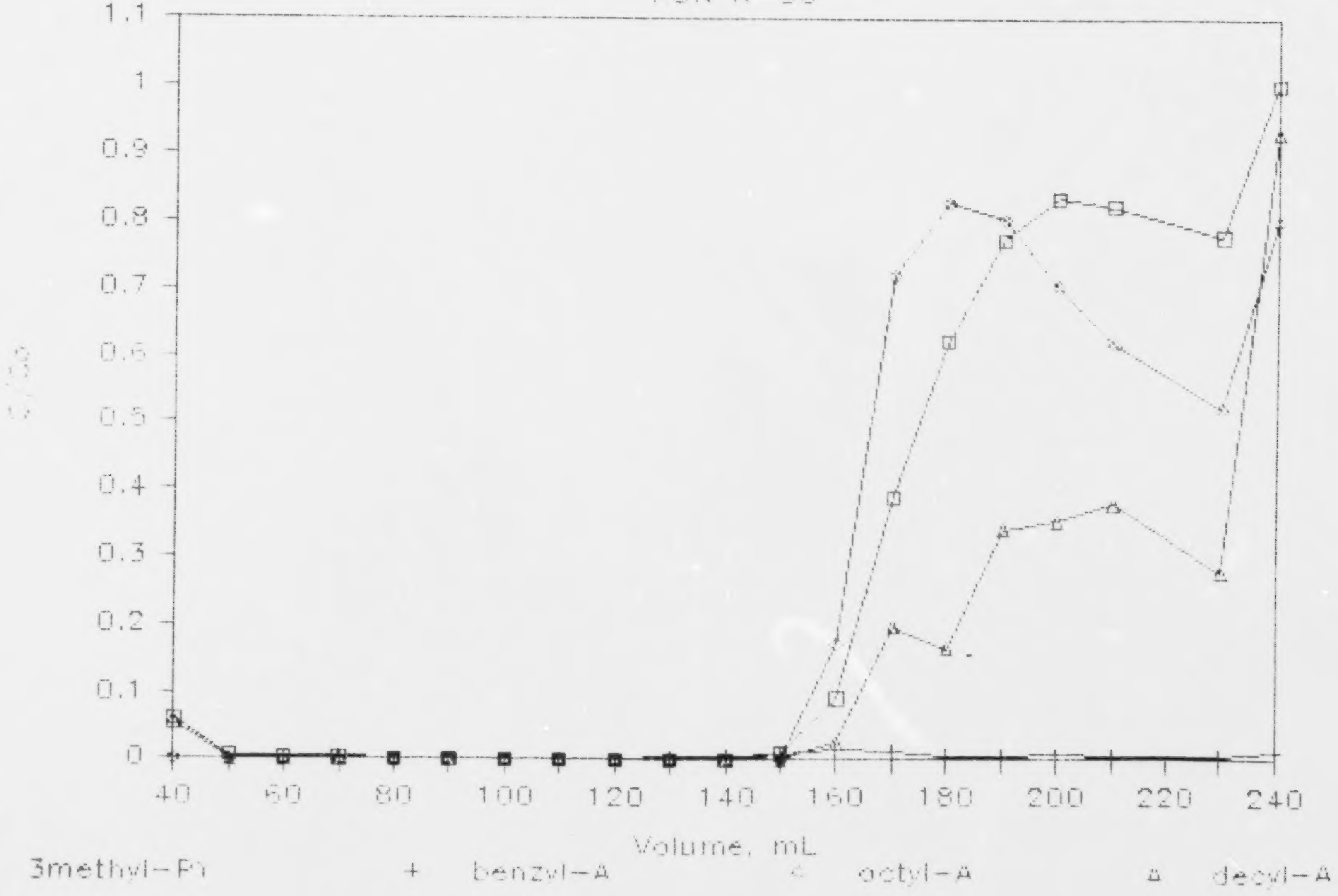
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-36



N–COMPOUNDS BREAKTHROUGH CURVES

RUN N-36



Run N-37: 13X (55 wt% of RUN N-23), 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

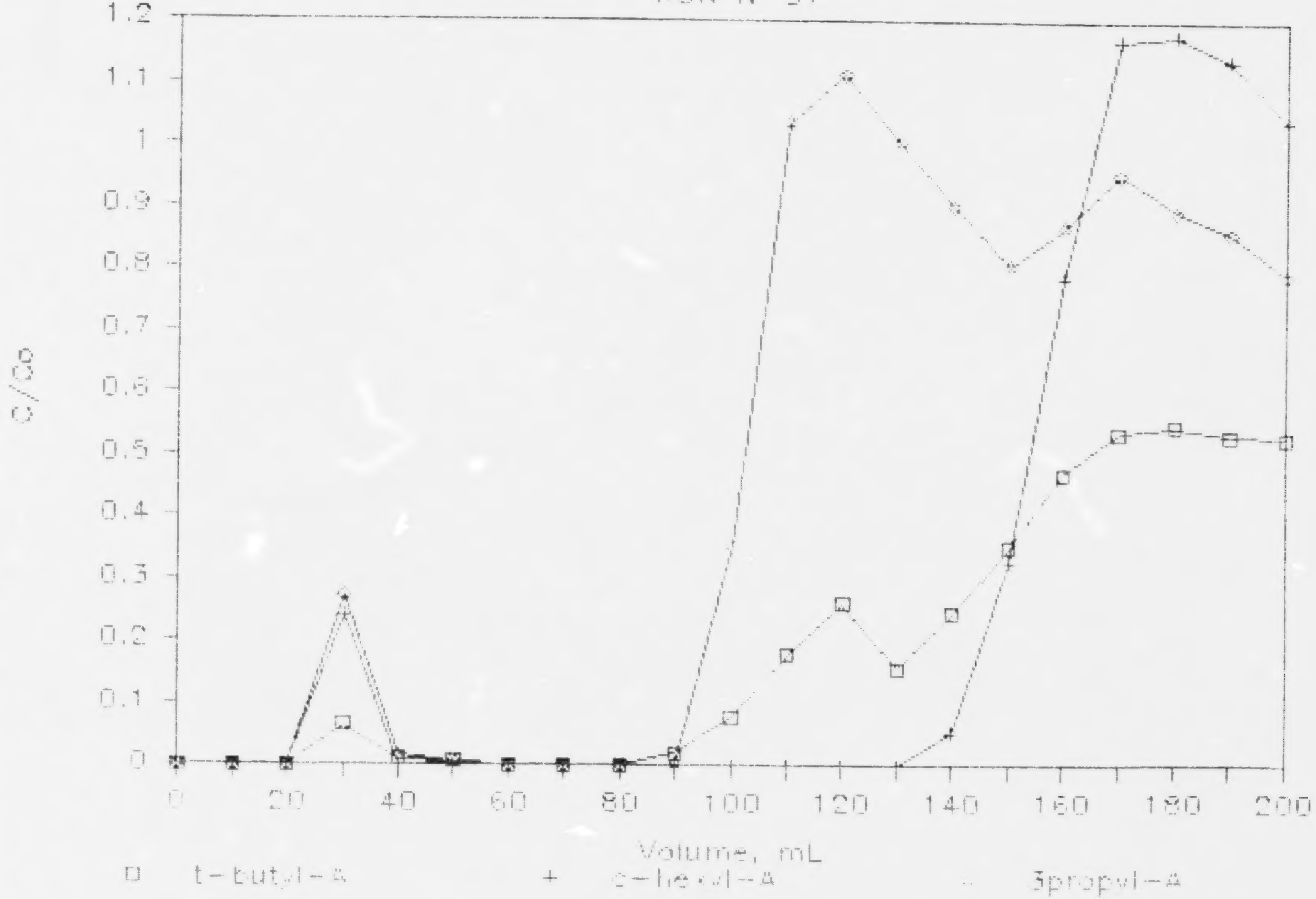
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0.0652743	0.241556	0.273677	0.0482851	0.039162	0.028063	0.802623	0.531479	0	0.49152	0.859693
4	40	0.0111136	0	0.0158641	0	0	0.00416543	0.04316	0.050156	0	0.0428403	0.035139
5	50	0.006835	0	0.005605	0	0	0	0.022962	0.025875	0	0.0155054	0.0320981
6	60	0	0	0	0	0	0	0.011641	0.013961	0	0	0.0196268
7	70	0	0	0	0	0	0.0063409	0.02227	0.02336	0	0	0.0216239
8	80	0	0	0	0	0	0.00403274	0.0136203	0.0146731	0	0	0.015233
9	90	0.0193123	0	0.00337363	0	0	0	0.015153	0.016021	0	0	0.0121229
10	100	0.0780719	0	0.354459	0	0	0.00689635	0.018422	0.017449	0	0	0.0262099
11	110	0.178581	0	1.03881	0	0	0	0.007594	0.009478	0	0	0
12	120	0.261163	0	1.11426	0.0258558	0.0150631	0	0.006209	0.086774	0.00686642	0.110991	0.0473195
13	130	0.15695	0	1.00704	0.0843535	0.053397	0.00534364	0.0144966	0.0377429	0.00878823	0.606288	0.223504
14	140	0.246157	0.053422	0.903119	0.11612	0.0783099	0.0126448	0.0265666	0.628287	0.0062999	0.871115	0.22684
15	150	0.351557	0.328616	0.807961	0.107935	0.0735675	0.0115305	0.0296687	0.655645	0.00696179	0.69192	0.330002
16	160	0.471174	0.786557	0.868783	0.092894	0.069189	0.010705	0.112944	0.695969	0.00722	0.602833	0.279137
17	170	0.538335	1.172619	0.953016	0.079673	0.058826	0.00787	0.53654	0.799762	0.008409	0.635043	0.357855
18	180	0.548374	1.179874	0.895263	0.069462	0.046664	0.015698	1.108379	0.740299	0.008392	0.580346	0.1937732
19	190	0.533106	1.140716	0.859207	0.099904	0.02939	0.043355	1.367367	0.684817	0.008817	0.511426	0.287736
20	200	0.529785	1.041927	0.792172	0.237667	0.019818	0.115715	1.352851	0.628099	0.007157	0.482057	0.283765

Run N-38: Carbon RZN-1 (45 wt% of Run N-29), 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0.164987	0.196132	1.9209	0.585273	0.0233192	1.28851	0	0	0	0
5	50	0	0	0.00907276	0.0507034	0.0209201	0.0834064	0.076762	0.0455497	0	0.0375558	0.0813196
6	60	0	0	0	0.0079904	0	0.0252238	0.0143408	0.00996037	0	0	0.0120849
7	70	0	0	0	0	0.00443038	0.800804	0.423901	0	0	0	0
8	80	0.761855	0	0	0	0	0.588704	1.153575	0	0	0	0.0022193
9	90	1.4533	0	0	0.10961	0.016761	0.671492	1.09055	0	0	0	0
10	100	1.39948	0	0	0.849993	0.275375	0.668276	0.916628	0	0	0	0
11	110	1.43423	0	0	1.14534	0.868384	0.583207	0.764913	0	0	0	0.00447336
12	120	1.35714	0	0	1.28158	1.30759	0.648782	0.927261	0	0	0	0.0190951
13	130	1.13202	0	0.0037391	1.01823	1.12119	0.508901	0.761752	0	0	0	0.0172621
14	140	1.38248	0	0.00499391	0.902286	0.997893	0.517383	0.758703	0	0	0	0.0242014
15	150	1.44963	0.0503035	0.00558845	0.862815	0.924892	0.537519	0.755386	0	0	0	0.0397145
16	160	1.25385	0.120144	0.00700933	0.89924	0.913516	0.559656	0.764498	0	0	0.0186538	0.0462436
17	170	1.20054	0.20189	0.044738	1.59762	1.51047	1.186812	1.826492	0	0	0.1856	0.603011
18	180	0.915201	0.181779	0.0267021	0.999477	0.940305	0.679342	1.011088	0	0	0.041271	0.244709
19	190	1.0242	0.168018	0.0187608	0.721866	0.732038	0.512488	0.622949	0	0	0	0.0532737
20	200	1.03111	0.171578	0.0199547	0.713225	0.701388	0.50603	0.627226	0	0	0	0.0409406
21	210	1.04297	0.171116	0.0197893	0.710241	0.697348	0.505225	0.626624	0	0	0.0185667	0.0399819
22	220	1.3053	0.203309	0.0331315	1.32341	1.25091	1.09538	1.610447	0	0	0.111638	0.422161
23	230	1.26788	0.194704	0.024512	1.05875	0.93944	0.761465	1.039292	0	0	0.0330871	0.196751
24	240	1.27987	0.231474	0.0328416	1.00491	0.978386	0.717968	0.905081	0.19426	0	0	0.105881

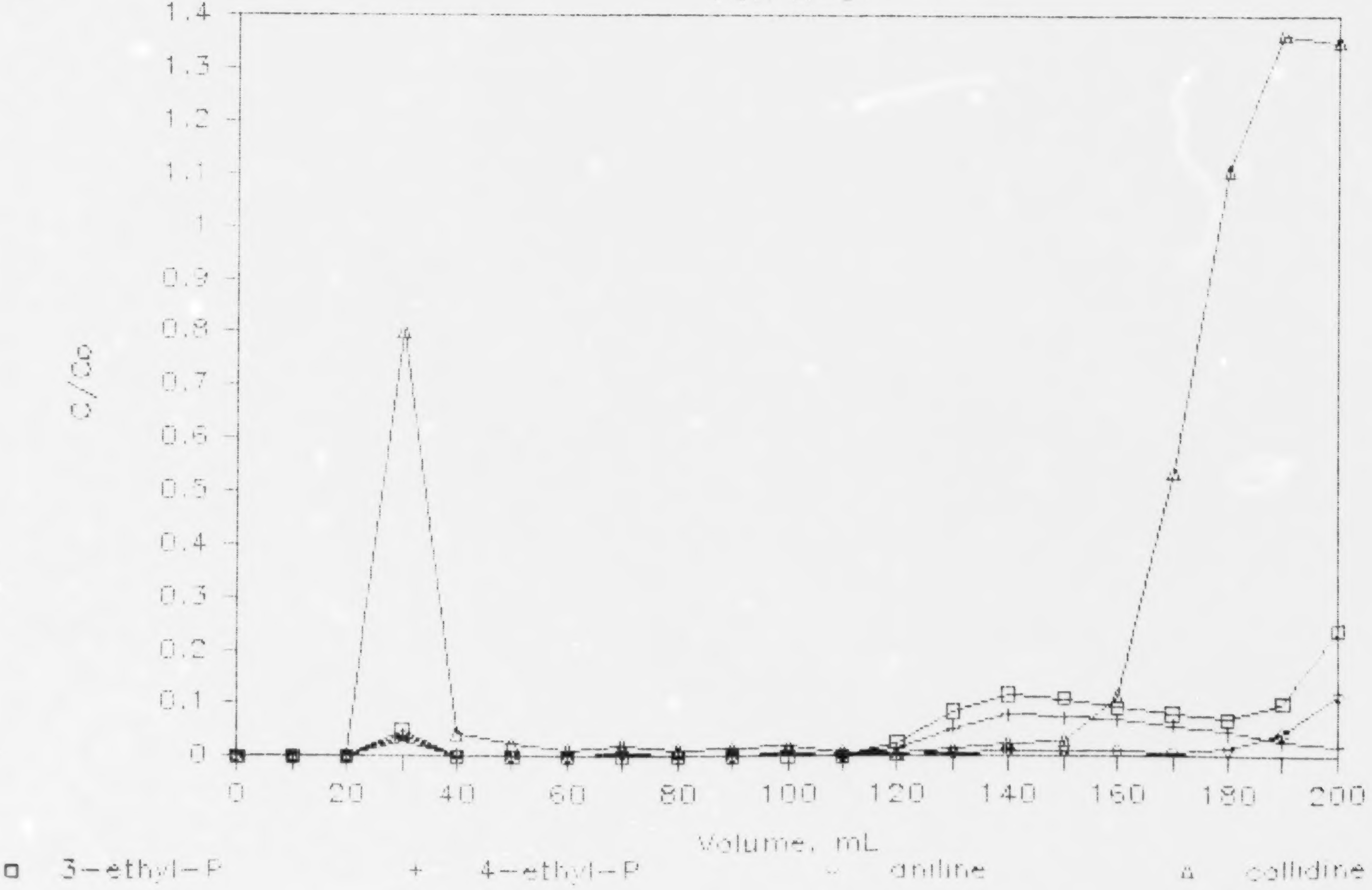
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-37



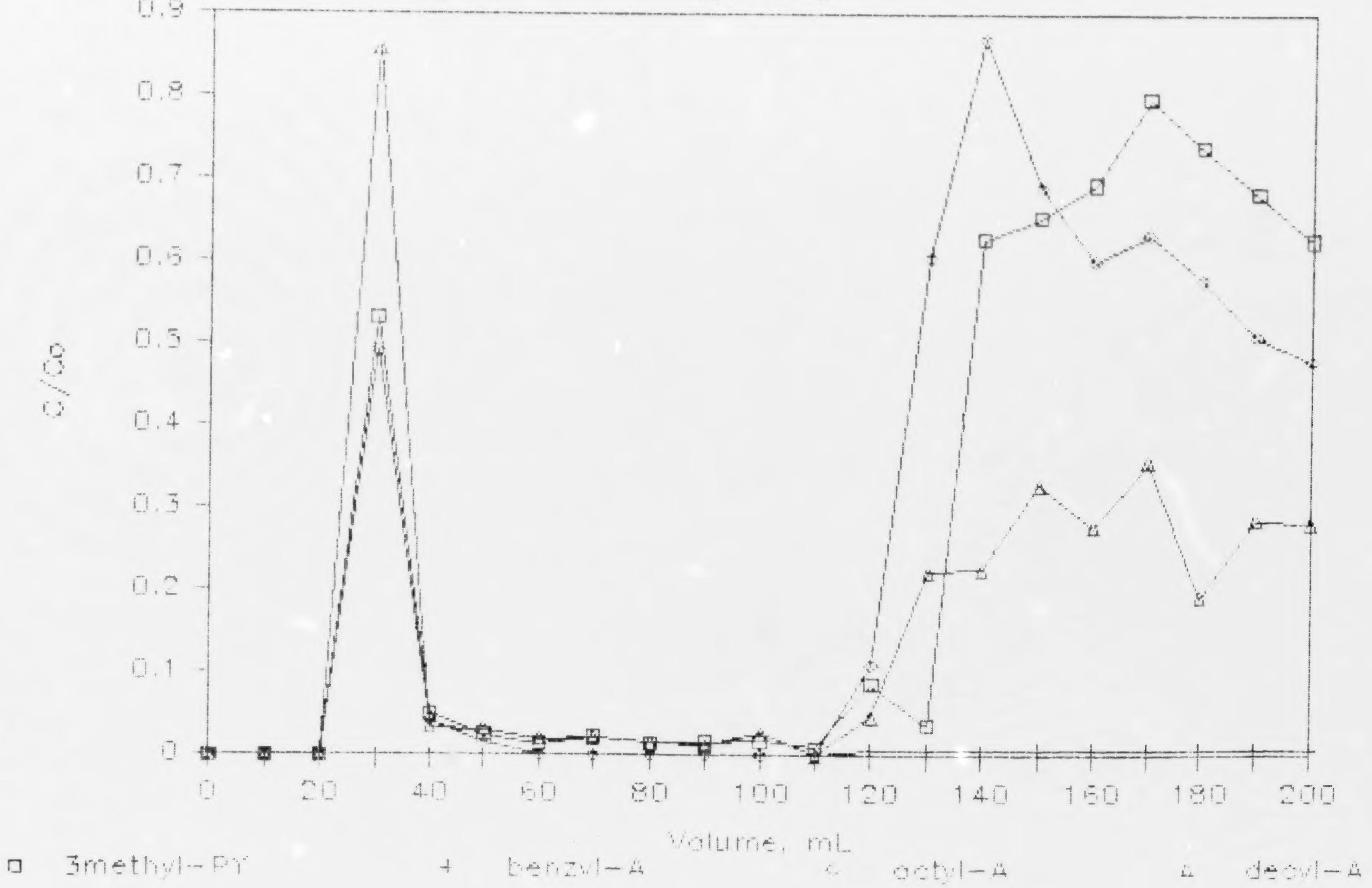
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-37



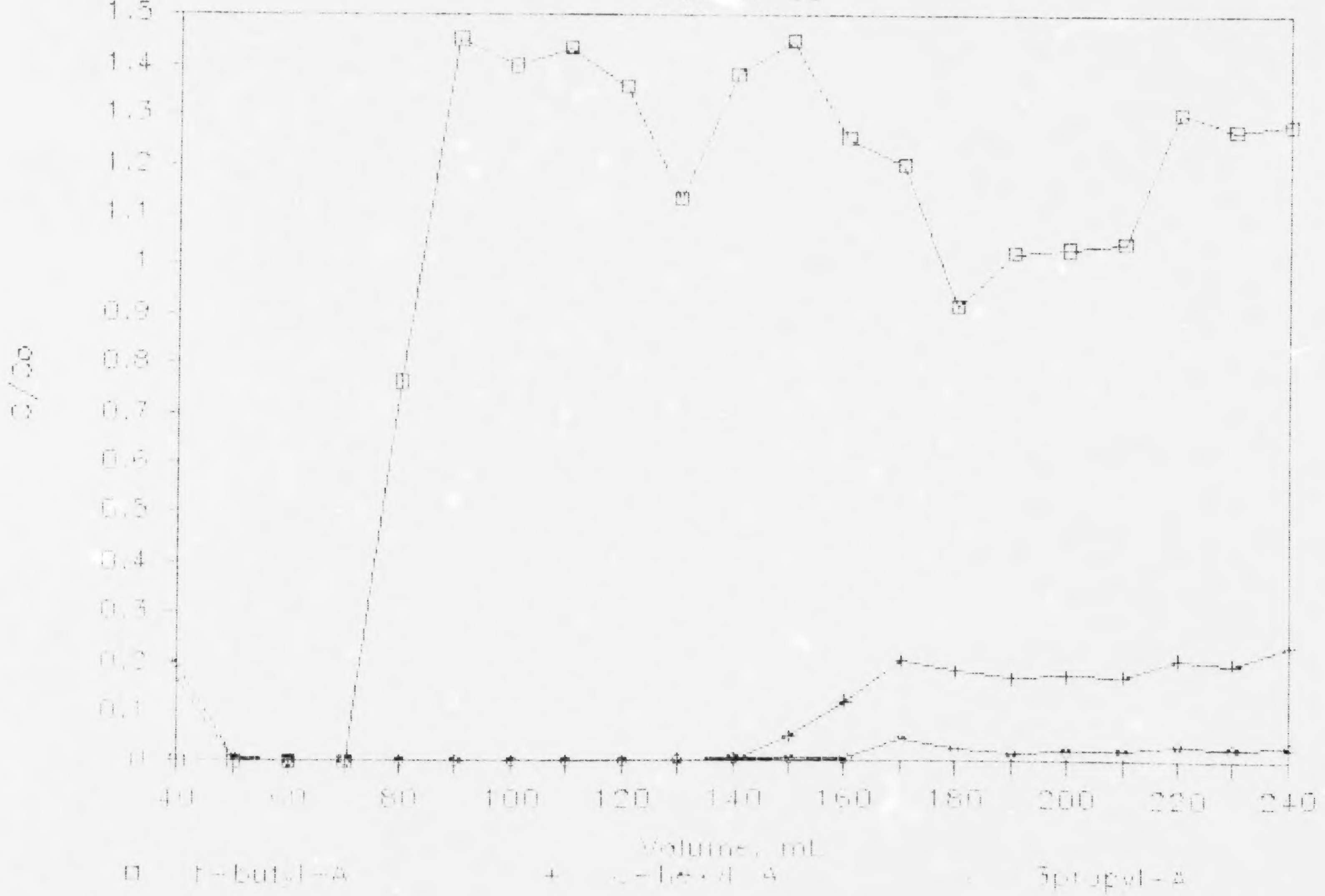
N-COMPOUNDS BREAKTHROUGH CURVES

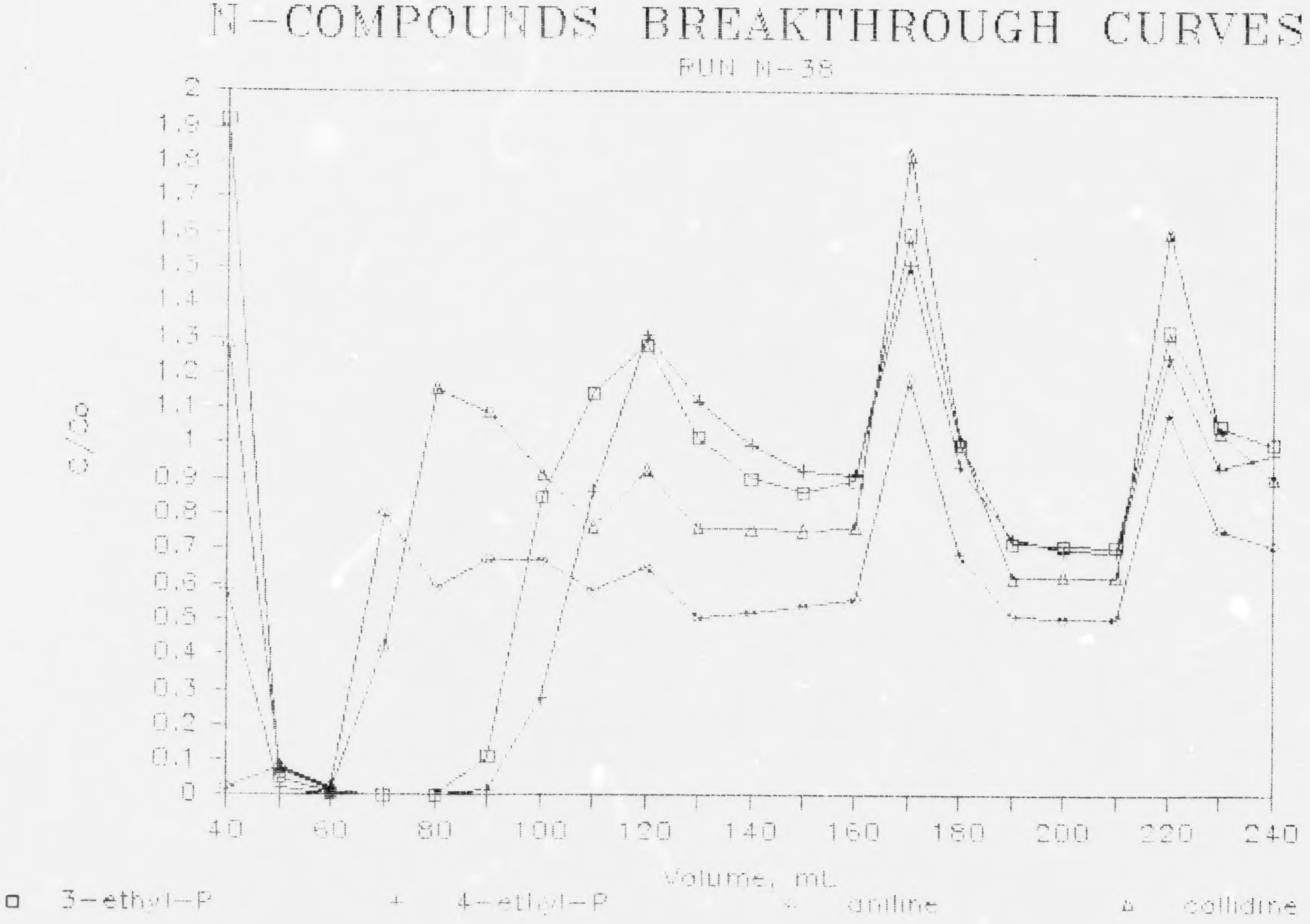
RUN N-37



N–COMPOUNDS BREAKTHROUGH CURVES

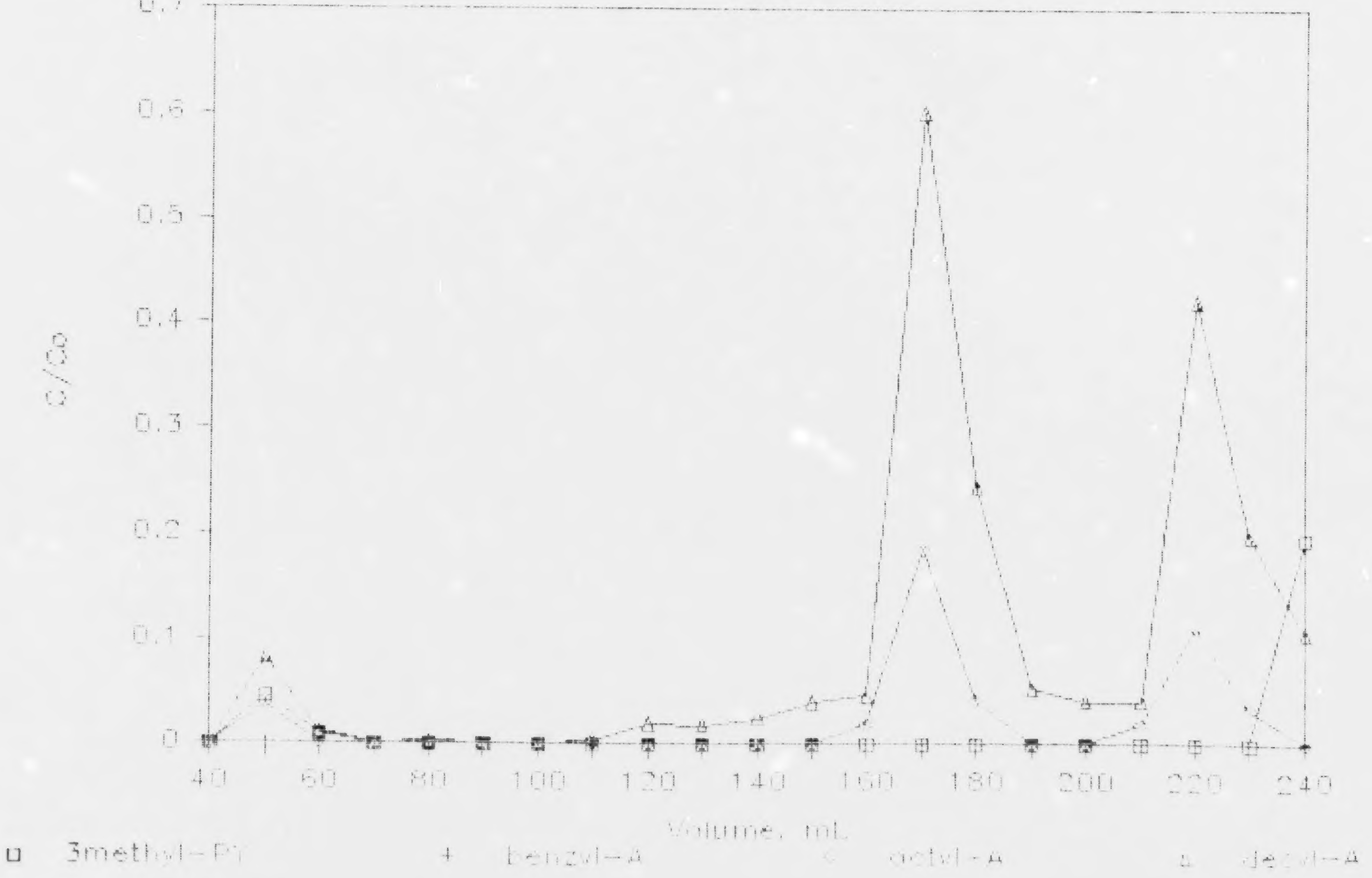
RUN N–38




N—COMPOUNDS BREAKTHROUGH CURVES
RUN N—38
C/Co
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
40
60
80
100
120
140
160
180
200
220
240
Volume, mL
□ 3—ethyl—P
+ 4—ethyl—P
◇ aniline
△ collidine

N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-38



Run N-33: Carbon RZN-1/13 X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.047381	0	0.032549	0.03739	0.047597	0.033121	0.046501	0.042515	0.012652	0.016557	0.023147
6	60	0.005317	0	0.013164	0.014224	0.01773	0.015258	0.022392	0.01691	0	0	0.017212
7	70	0	0	0.007965	0.007015	0.009904	0.009951	0.011847	0.010987	0	0	0
8	80	0	0	0.004517	0	0	0.005827	0.006806	0.006482	0	0	0
9	90	0	0	0	0	0	0	0.003033	0.003478	0	0	0
10	100	0	0	0	0	0	0	0	0	0	0	0
11	110	0.009368	0	0.003354	0	0	0.004679	0.004017	0.004517	0	0	0
12	120	0.009609	0	0	0	0	0	0	0	0	0	0
13	130	0	0	0	0	0	0	0	0	0	0	0
14	140	0	0	0	0	0	0	0	0.001567	0	0	0
15	150	0.016984	0	0	0	0	0	0	0	0	0	0
16	160	0.039507	0	0.005881	0.006801	0	0.005776	0.005098	0.006785	0	0	0
17	170	0.033636	0	0.015708	0.016986	0.012472	0.018311	0.014767	0.019031	0	0	0
18	180	0.02998	0	0.009656	0.016998	0.009419	0.01433	0.011318	0.014594	0	0	0
19	190	0.149553	0	0.014583	0.020634	0.010134	0.014656	0.01193	0.014889	0	0	0
20	200	0.761948	0	0.011493	0.019442	0.006754	0.010729	0.008865	0.011253	0	0	0.021538
21	210	1.049106	0	0.019937	0.027029	0.012631	0.018886	0.015775	0.019971	0	0	0.007665
22	220	1.297653	0	0.018254	0.029471	0.010422	0.018435	0.015644	0.018008	0	0	0.023633
23	230	1.161761	0	0.011349	0.036333	0.018341	0.016494	0.115556	0.027552	0.006237	0.02057	0.079679
24	240	0.814763	0	0.034484	0.029481	0.011095	0.022949	1.427374	0	0	0.007454	0.164705

Run N-34: 13 X/Carbon RZN-1, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

C/Co

#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0.014799	0	0.014437	0.067143	0.055991	0.118511	0.341067	0.098352	0	0	0.060855
5	50	0	0	0.00426306	0.00782	0.01622	0.027358	0.042408	0.020581	0	0	0
6	60	0	0	0	0	0	0.015181	0.01593	0.010619	0	0	0
7	70	0	0	0	0	0	0.015829	0.014179	0.009127	0	0	0
8	80	0	0	0	0	0.00766247	0.018955	0.017704	0.011009	0	0	0
9	90	0	0	0	0	0	0.017692	0.012273	0.009411	0	0	0
10	100	0	0	0	0	0	0.010978	0.010646	0.006134	0	0	0
11	110	0	0	0	0	0	0	0.00343292	0	0	0	0
12	120	0	0	0	0	0	0.00995626	0.009178	0.00608	0	0	0
13	130	0	0	0	0	0	0	0.00397	0	0	0	0
14	140	0	0	0	0	0	0.015278	0.011416	0.00914	0	0	0
15	150	0	0	0	0	0	0.0160146	0.014842	0.009088	0	0	0
16	160	0	0	0	0	0.008064	0.020826	0.022043	0.011665	0	0	0
17	170	0.0122712	0	0	0	0	0.0129957	0.013943	0.009551	0	0	0
18	180	0.022083	0	0	0	0.010524	0.020704	0.029035	0.018253	0	0	0.019619
19	190	0.019379	0	0	0.003961	0.007079	0.016186	0.017171	0.010715	0	0	0
20	200	0.019344	0	0	0	0	0	0.003854	0.003473	0	0	0
21	210	0.470324	0	0	0	0	0.00418309	0.012861	0.008129	0	0	0
22	220	1.076606	0	0	0.004545	0.00483	0.004579	0.019063	0.010648	0	0	0.018819
23	230	1.503822	0	0	0.009395	0.010616	0.01649	0.029273	0.020889	0	0	0.049544
24	240	2.44319	0	0	0.00552395	0.00623052	0.00740521	0.057834	0.011299	0	0	0

Run N-47: 13X/Carbon RZN-1, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0	0	0	0	0	0	0	0
6	60	0	0	0	0	0	0	0	0	0	0	0
7	70	0	0	0	0.017467	0	0	0	0	0	0	0.032503
8	80	0	0	0	0.00691	0	0	0.003426	0	0	0	0
9	90	0	0	0	0	0	0.006926	0.004188	0	0	0	0.010792
10	100	0.016184	0	0	0	0	0	0.00533	0	0	0	0
11	110	0.043157	0	0	0	0	0	0	0	0	0	0
12	120	0.055193	0	0	0	0	0	0	0	0	0	0
13	130	0.069304	0	0	0	0	0	0	0	0	0	0
14	140	0.042142	0	0	0	0	0	0.011704	0	0	0	0
15	150	0.628874	0	0	0	0	0	0.014134	0.007703	0	0	0
16	160	1.840548	0	0	0.008103	0.007013	0	0.014172	0.018509	0	0	0.011469
17	170	2.126511	0	0	0.011314	0.015602	0	0.122385	0.035009	0	0	0.015723
18	180	1.946271	0	0	0.013779	0.013255	0.007752	0	0	0	0	0.027389
19	190	1.61928	0	0	0.017748	0.009454	0.024895	0	0	0	0	0.046736
20	200	1.457858	0	0.004182	0.020057	0.01129	0.104499	0	0	0	0	0.063645
21	210	1.489125	0	0.010375	0.028317	0.007786	0.390009	0	0	0	0	0.093342
22	220	1.545949	0	0.023454	0.158204	0.020101	0.666511	0	0	0	0	0.110798
23	230	1.389298	0	0.048759	0.857913	0.024268	0.773799	0	0	0	0	0.11652
24	240	1.131964	0.125919	0.075832	1.805669	0.049637	0.887675	1.186758	0.223627	0	0	0.117837

Run N-35: Mix (13 X, Carbon RZN-1), 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0.0036112	0	0.007761	0.029412	0.025938	0.053489	0.434133	0.067984	0	0	0
5	50	0	0	0	0	0	0.016289	0.015043	0.008309	0	0	0
6	60	0	0	0	0	0	0.013646	0.004756	0.005414	0	0	0
7	70	0	0	0	0	0	0	0.004646	0	0	0	0
8	80	0	0	0	0	0	0.005364	0.004092	0	0	0	0
9	90	0	0	0	0	0	0.004278	0.004092	0	0	0	0
10	100	0	0	0	0	0	0.018212	0.013383	0.008561	0	0	0
11	110	0	0	0	0	0	0.017027	0.011614	0.00768	0	0	0.008939
12	120	0	0	0	0	0	0.012931	0.00907	0.005665	0	0	0
13	130	0	0	0	0	0	0.019659	0.013826	0.008687	0	0	0
14	140	0	0	0	0.005632	0	0.024022	0.015485	0.009694	0	0	0.011235
15	150	0	0	0	0.006727	0	0.013992	0.009402	0.006043	0	0	0.024281
16	160	0.027702	0	0.003293	0.014515	0	0	0	0	0	0	0
17	170	0	0	0.004704	0.022637	0	0	0	0	0	0	0
18	180	0.141479	0	0.005409	0.029376	0	0	0	0	0	0	0
19	190	0.806085	0	0.005174	0.029031	0	0	0.007296	0.0006254	0	0	0
20	200	1.110067	0	0.004704	0.027648	0.004553	0	0.126472	0.011745	0	0	0
21	210	1.060351	0	0.006468	0.024711	0.009757	0.009239	0.775858	0.026236	0	0	0.011145
22	220	0.985238	0	0	0.022262	0.007458	0.034207	2.244969	0	0	0	0.060897
23	230	0.929411	0	0	0.034719	0.003645	0.136486	2.777359	0	0	0	0.106038
24	240	0.859611	0	0	0.179666	0	0.44601	2.366962	0	0	0	0.121534

Run N-42: Carbon RZN-1/13 X/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

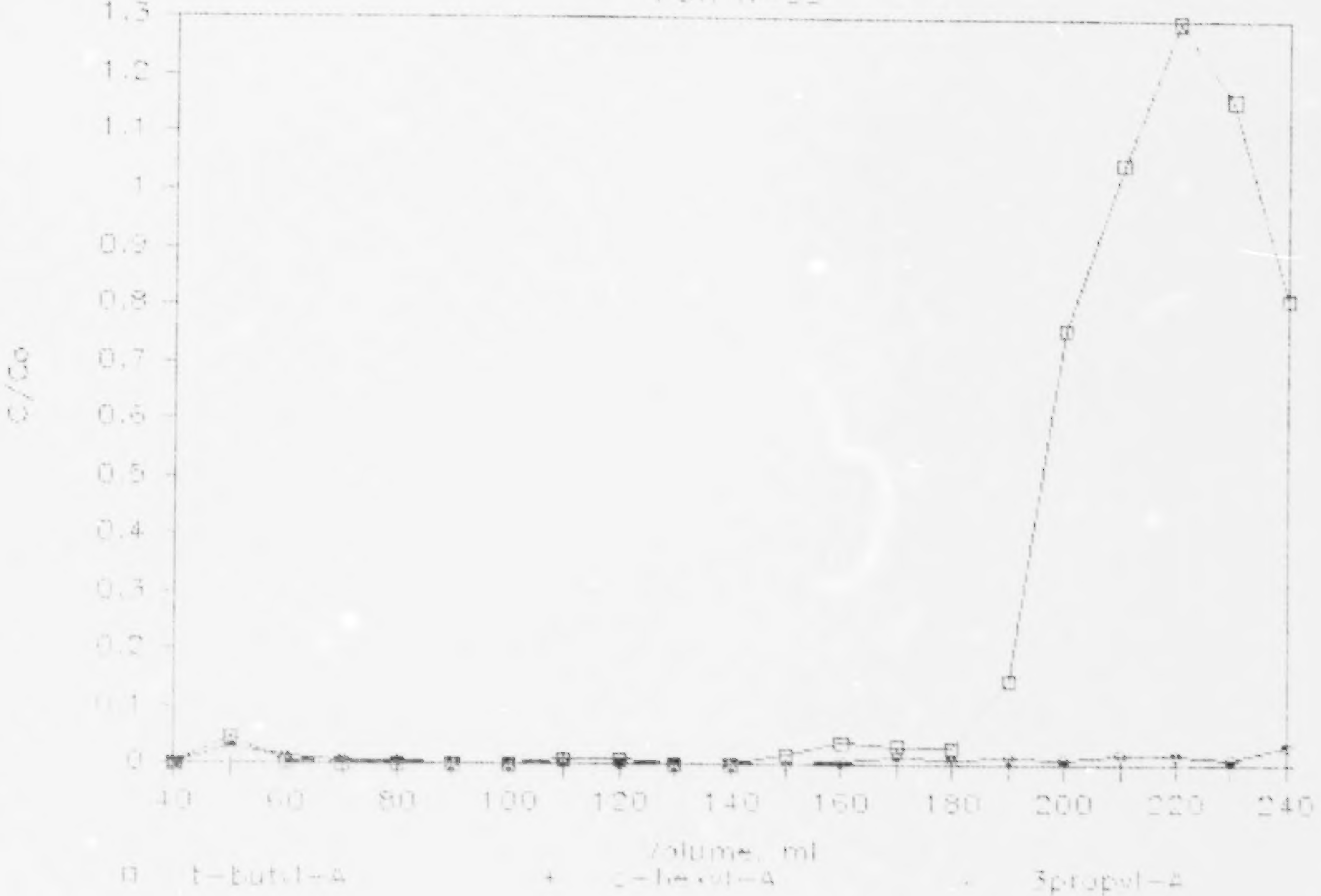
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.026624	0	0.0705153	0.027238	0.059007	0.104762	0	0	0.100086	0.0070405	0.110223
6	60	0.006106	0	0	0	0.072301	0.016575	0.03426	0.00647554	0.0378815	0.00232224	0.00229076
7	70	0.0149	0	0.002047	0	0.093055	0.011759	0.00312	0	0.064153	0.00420639	0.0020899
9	90	0.017587	0	0.00307	0	0.089799	0.009671	0	0.00211108	0.126252	0.00570189	0.00402729
10	100	0.012457	0	0.002501	0	0.070673	0.007029	0	0.00294493	0.0773157	0.00567551	0.00983413
11	110	0.005618	0	0.001582	0	0.04178	0.005021	0.002558	0.00432352	0.0764895	0.00479262	0.0132431
12	120	0	0	0	0	0.01682	0.004495	0.003479	0.00340044	0.0313833	0.00284052	0.0134739
13	130	0	0	0	0.002429	0	0	0	0	0.0521523	0	0.0054467
14	140	0.0154203	0	0	0.004164	0	0	0	0	0	0	0.0054473
15	150	0.010503	0	0.002501	0.006277	0	0	0.002524	0	0	0	0
16	160	0.010015	0	0.003525	0.014573	0	0	0	0	0	0	0
17	170	0.121032	0	0.00458875	0.0213669	0	0	0.00238	0	0	0	0
18	180	0.568225	0	0.00379306	0.0206301	0	0	0.003496	0	0	0	0
19	190	1.237	0	0.00347368	0.0238478	0.00813059	0	0.00708	0.00955451	0	0.00951187	0.0419208
20	200	1.02847	0	0.00465265	0.0293863	0.0168397	0.013735	0.129393	0.0160858	0	0.013245	0.081345
21	210	0.846873	0	0.00730446	0.029508	0.0119315	0.02565	0	0	0	0.0151368	0.0681686
22	220	0.675338	0	0.012517	0.0392359	0.0151097	0.050733	0	0	0	0.0153833	0.0824508
23	230	0.650847	0	0.0144836	0.0504169	0.0143652	0.110836	0	0	0	0.012585	0.0859002
24	240	0.781716	0	0.0149214	0.127411	0.00364072	0.35776	0	0	0	0.003922	0.0747343

Run N-48: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0	0	0	0	0	0	0	0
6	60	0	0	0	0	0.014483	0.006929	0.007182	0	0	0	0.017833
7	70	0	0	0	0	0.033498	0.00526	0	0	0	0	0
8	80	0.00826	0	0	0	0.054905	0.006128	0	0	0	0	0
9	90	0.007157	0	0.002766	0	0.044274	0.004914	0.003339	0	0	0	0.013855
10	100	0	0	0	0	0.030248	0	0.00384	0	0	0	0.019542
11	110	0	0	0	0	0.021277	0	0.004142	0	0	0	0.015998
12	120	0	0	0	0	0.021315	0	0.005343	0	0	0	0.009855
13	130	0	0	0	0	0.018312	0	0.004639	0	0	0	0.024024
14	140	0	0	0	0	0.01917	0	0.005618	0	0	0	0.030636
15	150	0	0	0	0	0.014007	0	0.005092	0	0	0	0.026822
16	160	0	0	0	0	0	0	0	0	0	0	0.020935
17	170	0.477246	0	0	0	0	0	0.007985	0	0	0	0.007024
18	180	1.127622	0	0	0.004834	0.008128	0	0.013947	0	0	0	0.005988
19	190	1.205848	0	0	0.005973	0.005939	0.021457	0.233947	0.008496	0	0	0.013667
20	200	0.916142	0	0	0.009352	0.012192	0.063506	0	0	0	0	0.037741
21	210	0.865305	0	0	0.011586	0.013915	0.18028	0	0	0	0	0.044037
22	220	0.897575	0	0	0.023957	0.013895	0.385009	0	0	0	0	0.048595
23	230	0.930675	0	0.003619	0.256016	0.026414	0.542437	0	0	0	0	0.058075
24	240	0.833753	0	0.007619	1.052757	0.062728	0.616452	0	0	0	0	0.061919

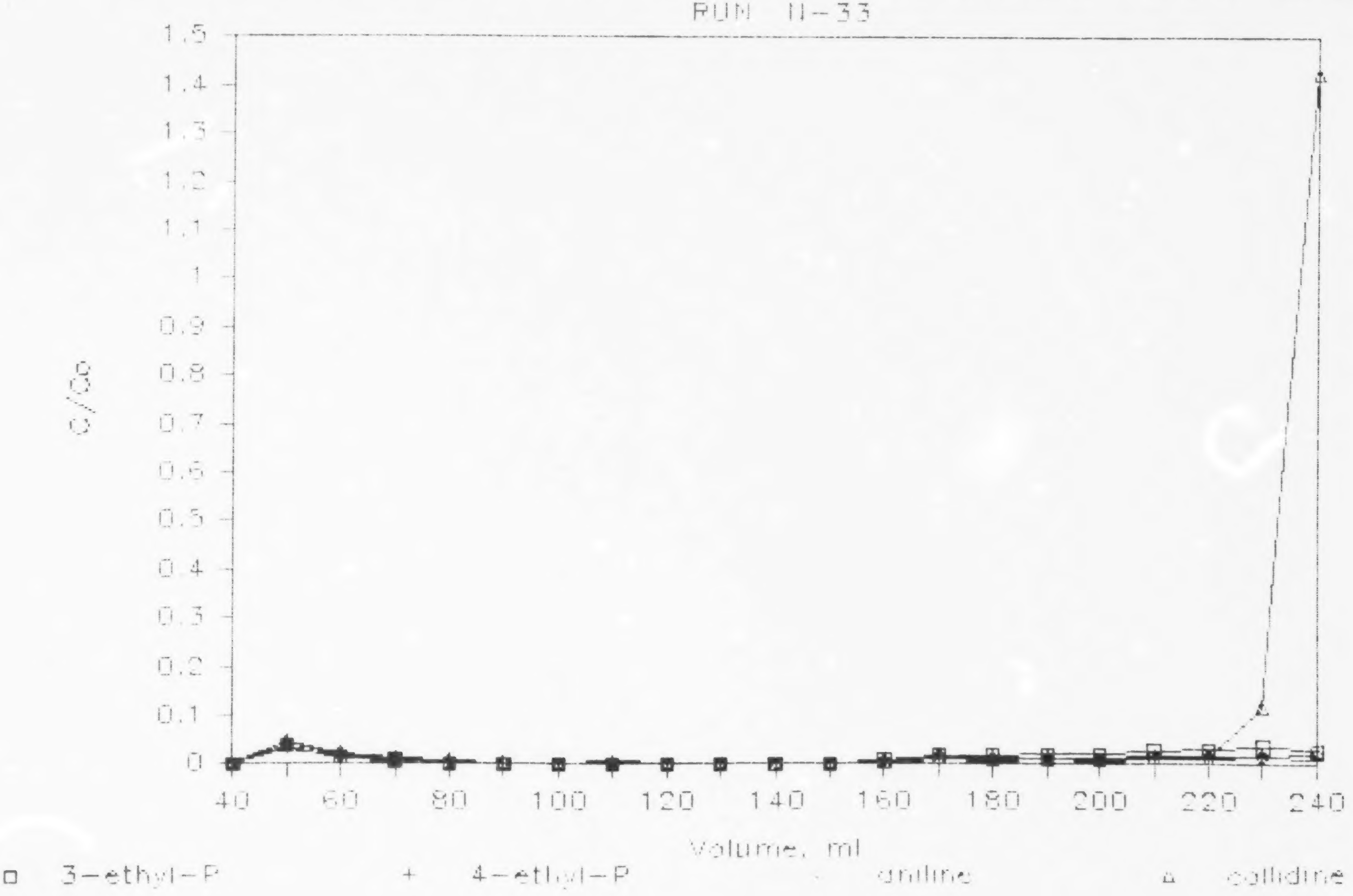
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-33



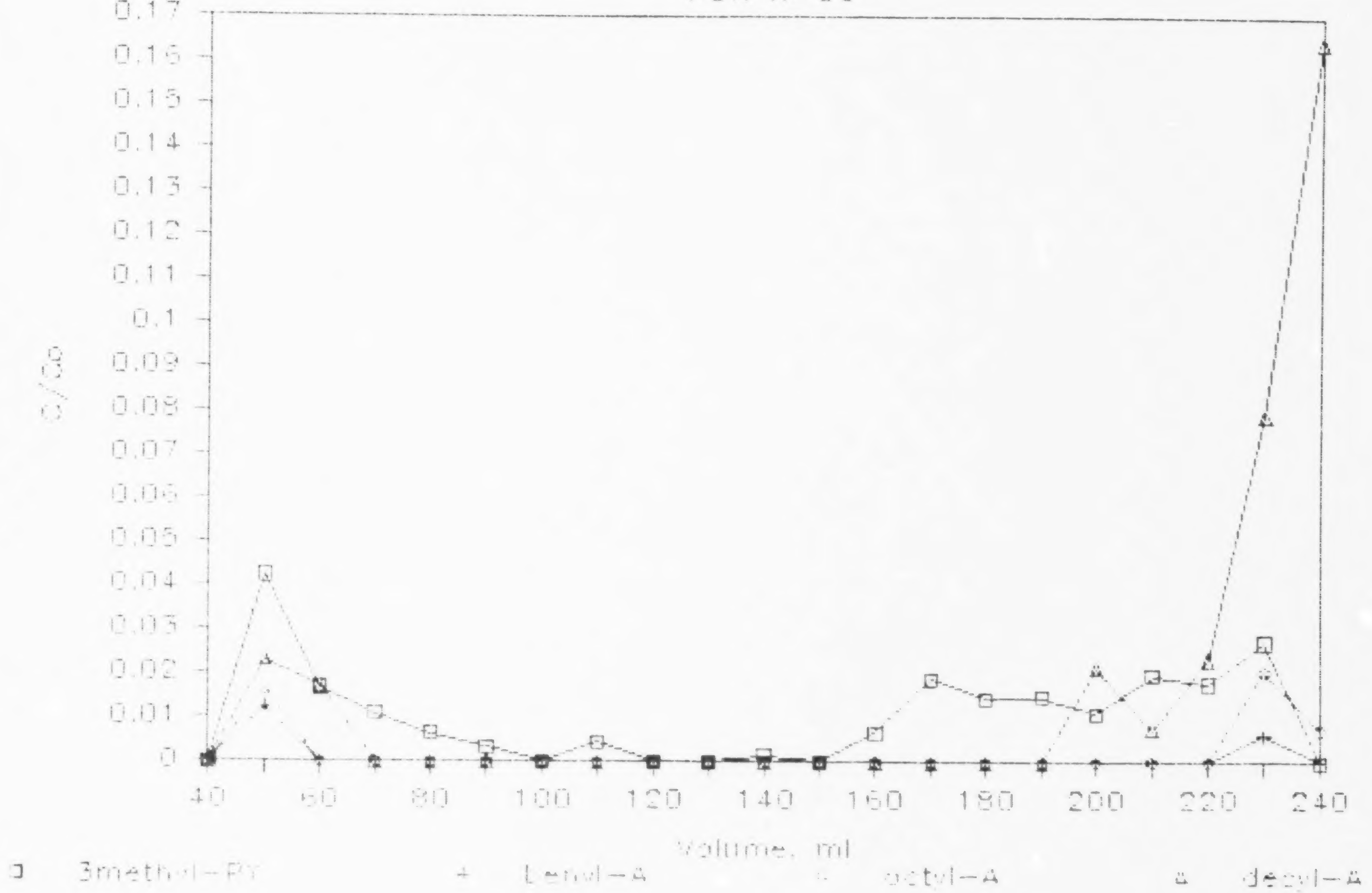
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N—33



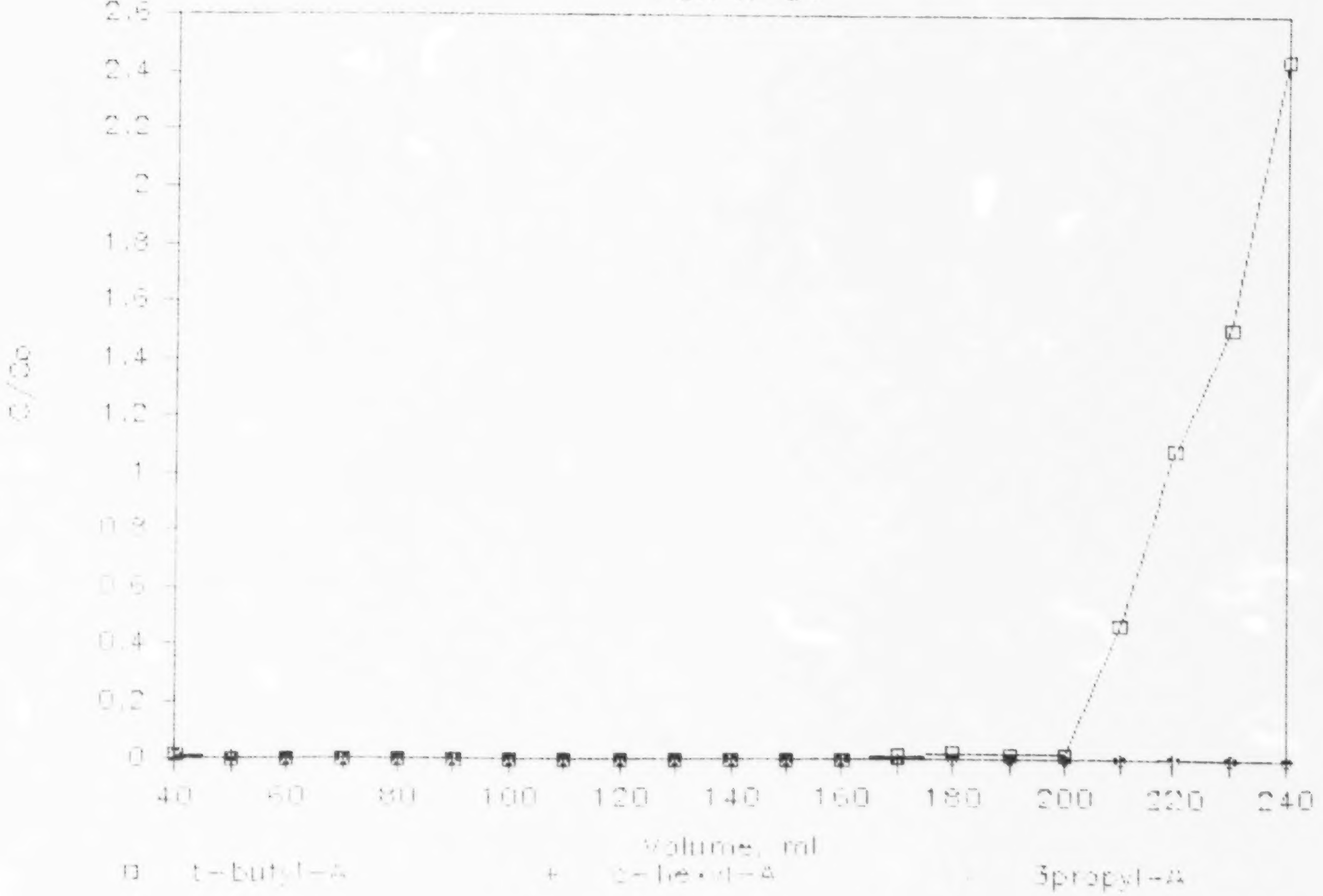
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-33



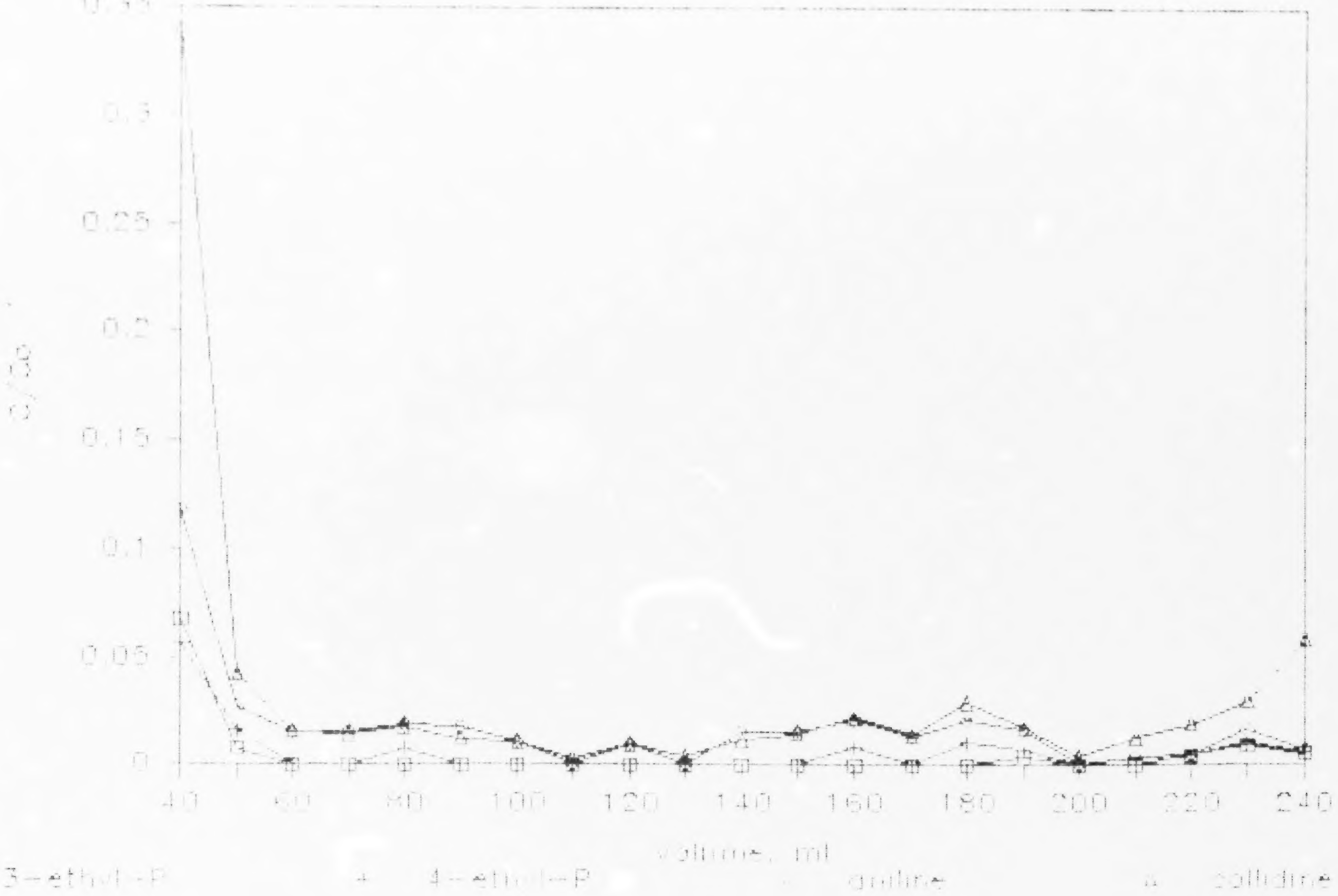
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-34



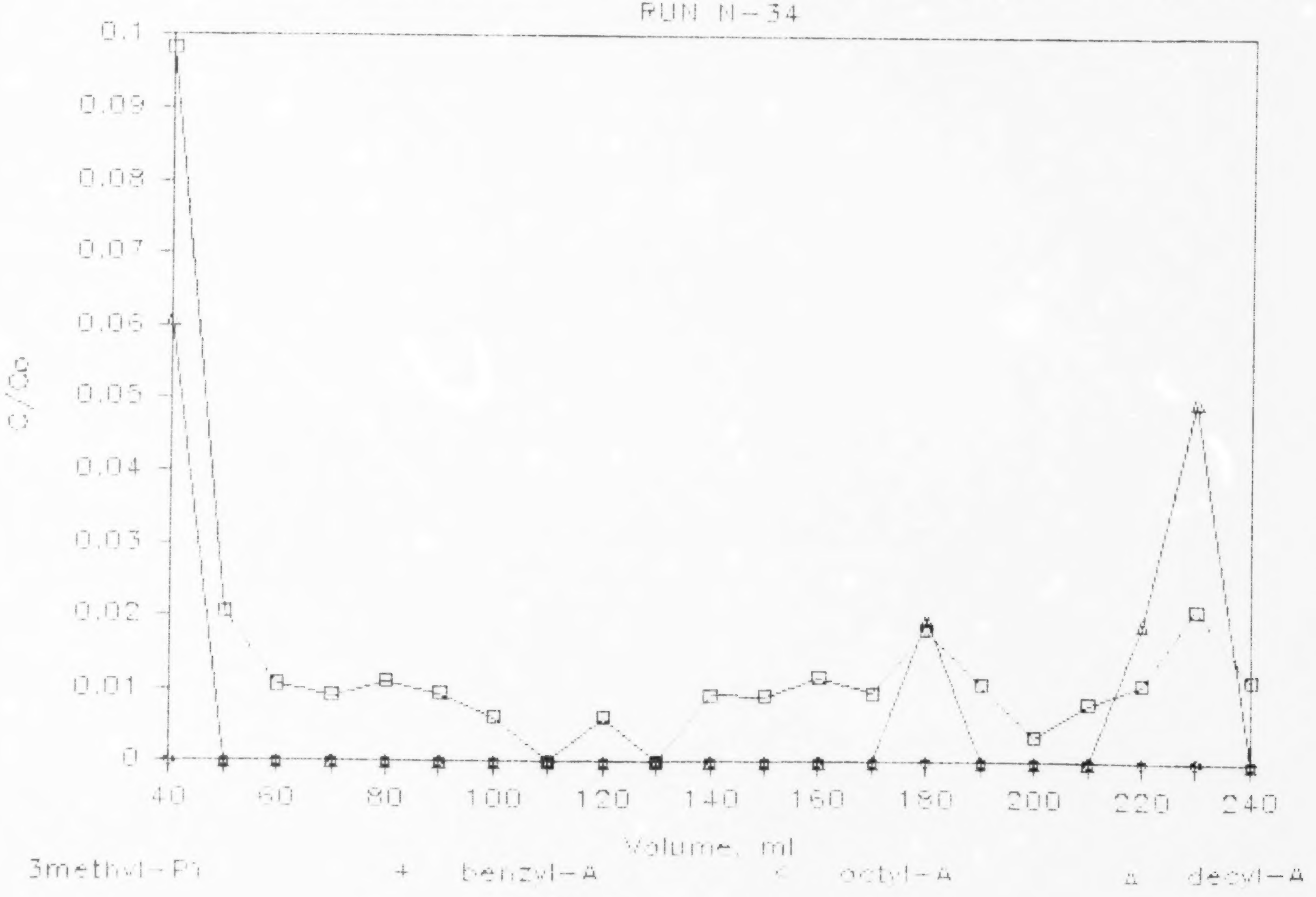
N-COMPOUNDS BREAKTHTOUGH CURVES

RUN N-34



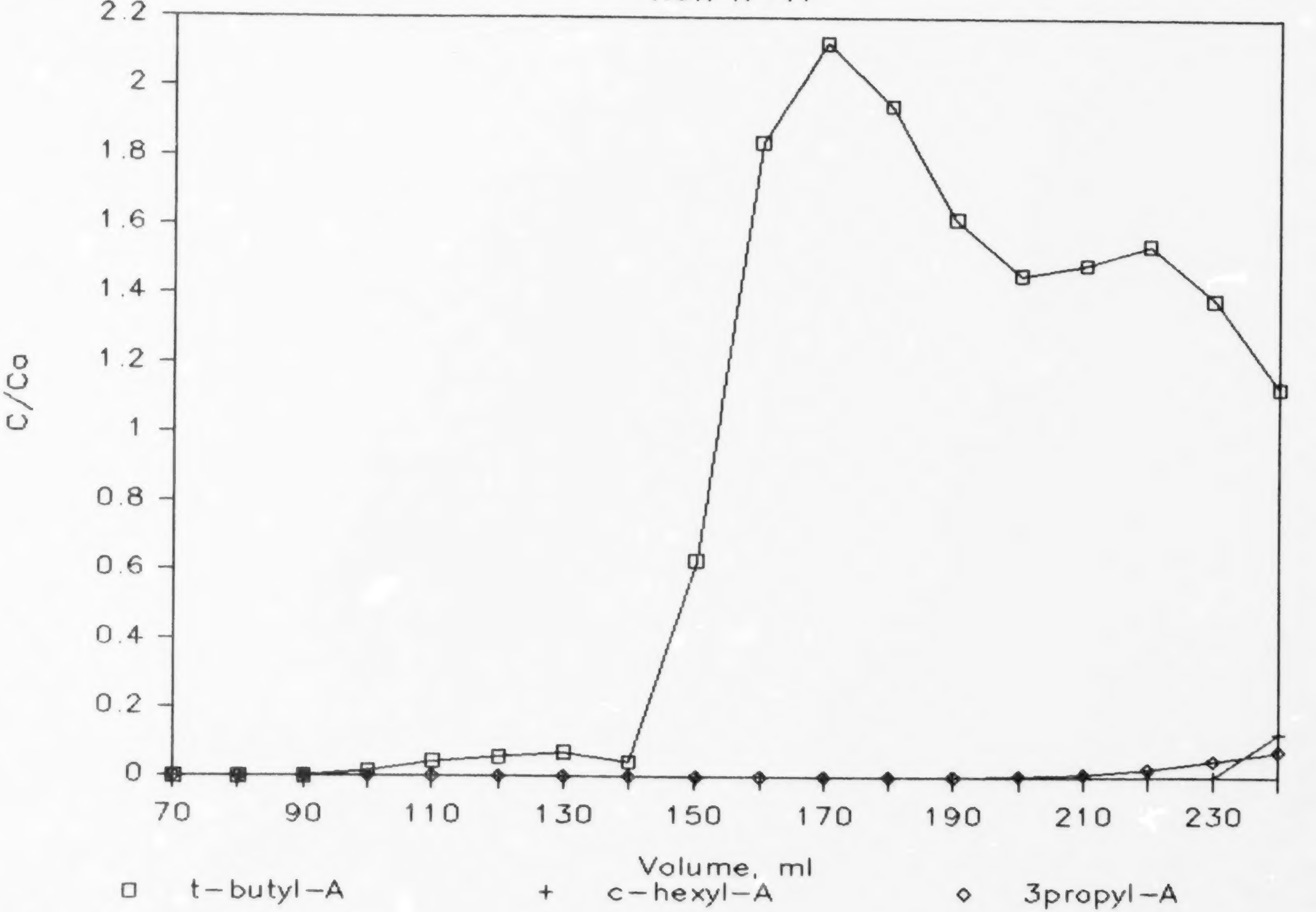
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-34



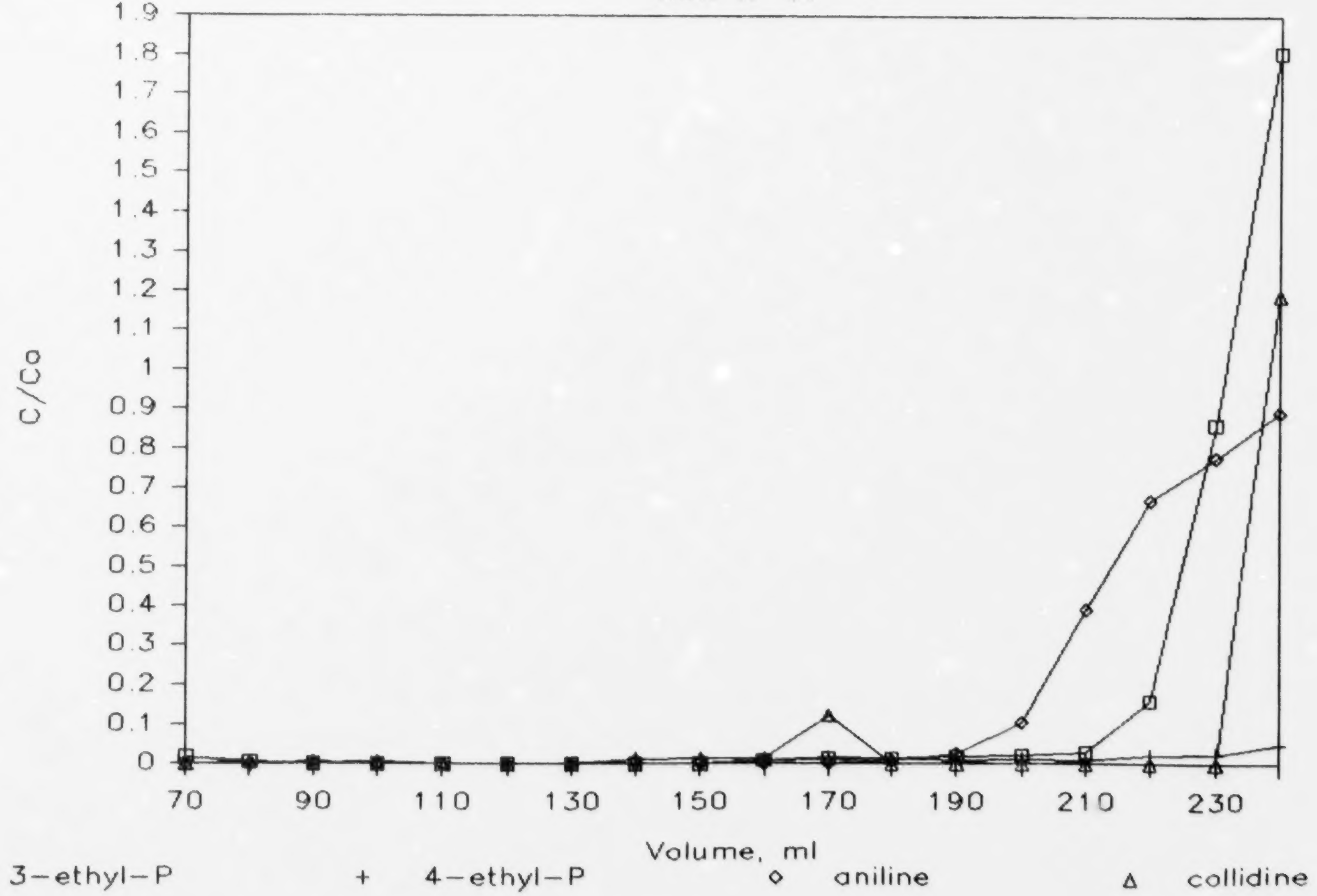
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-47



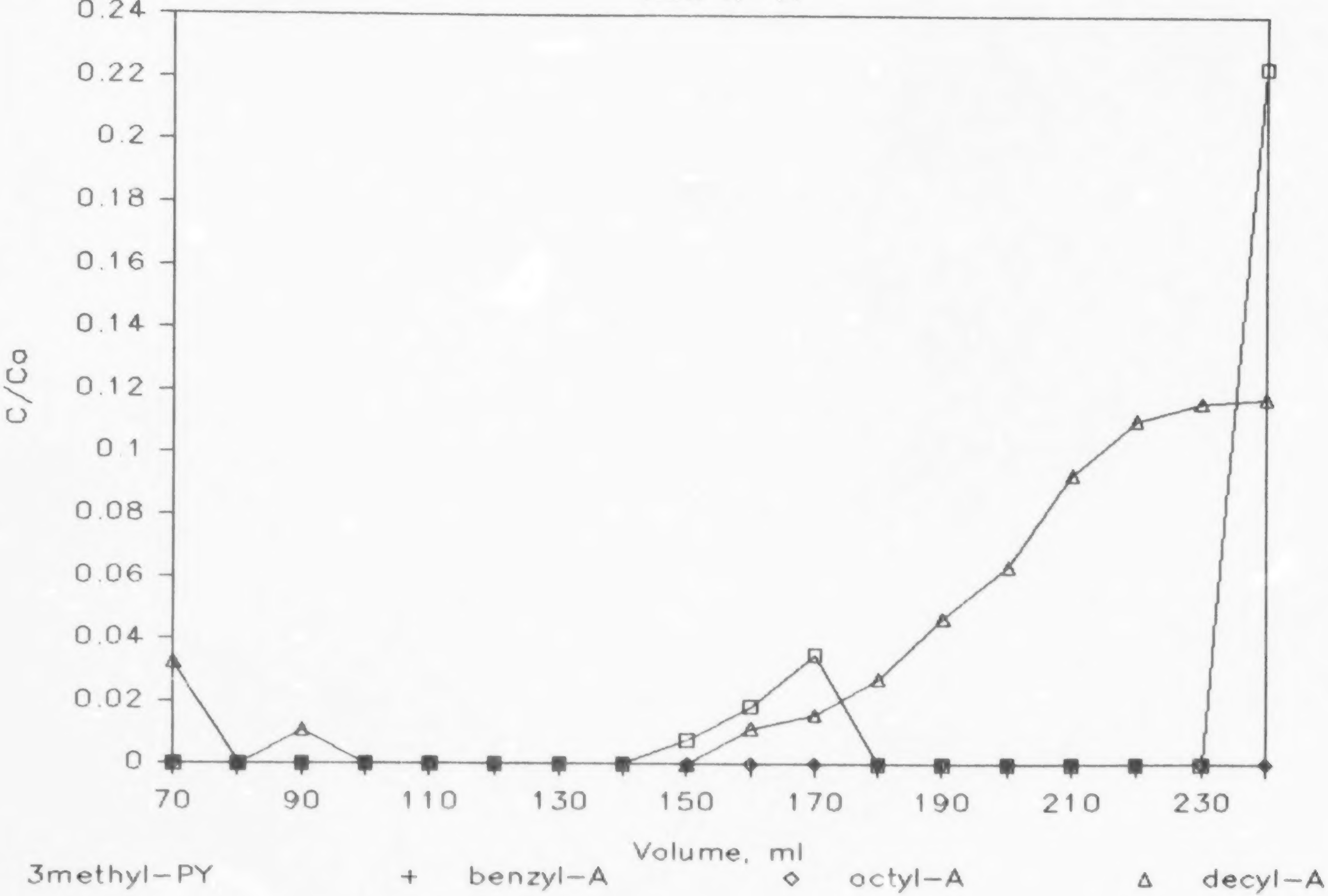
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–47



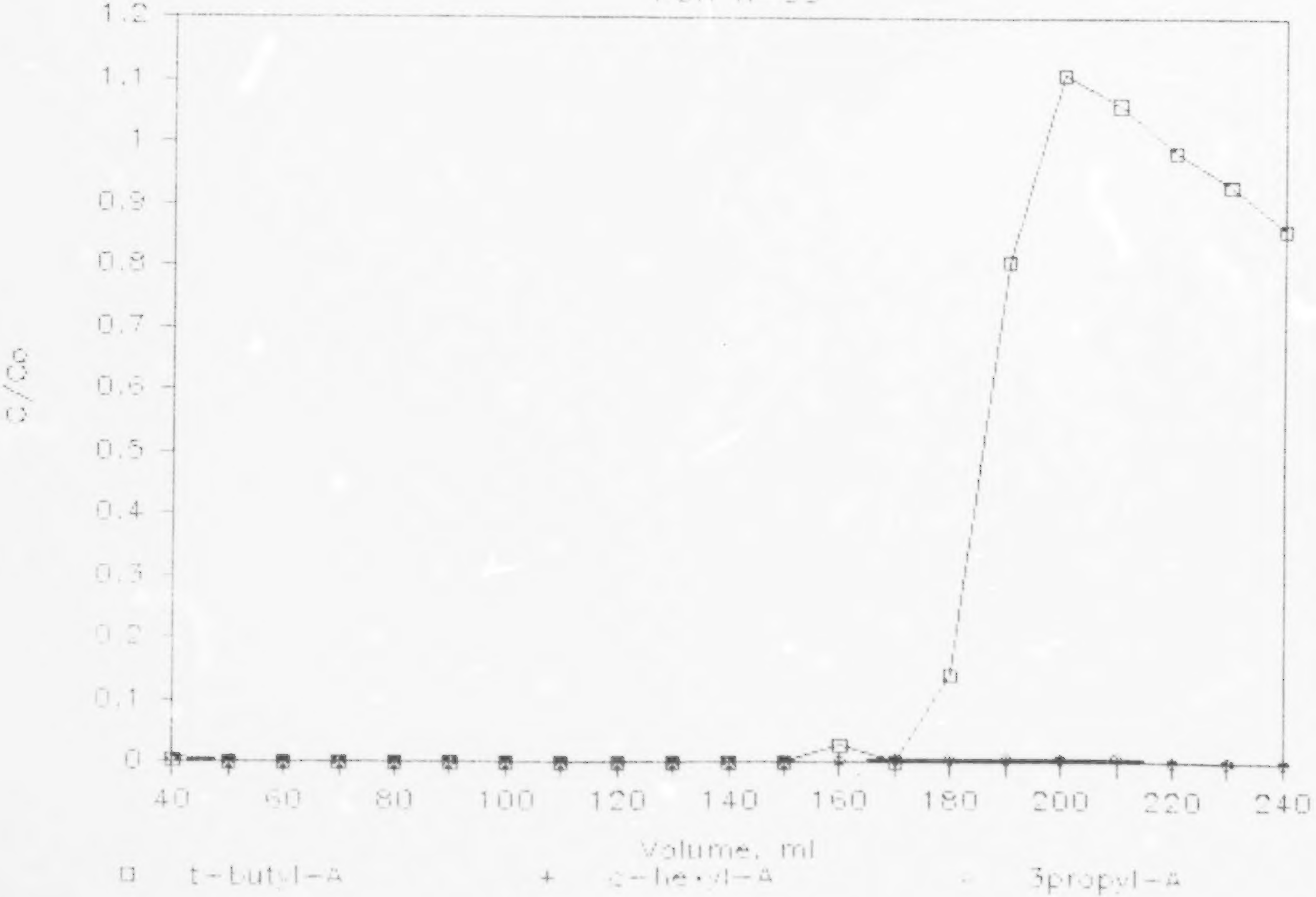
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-47



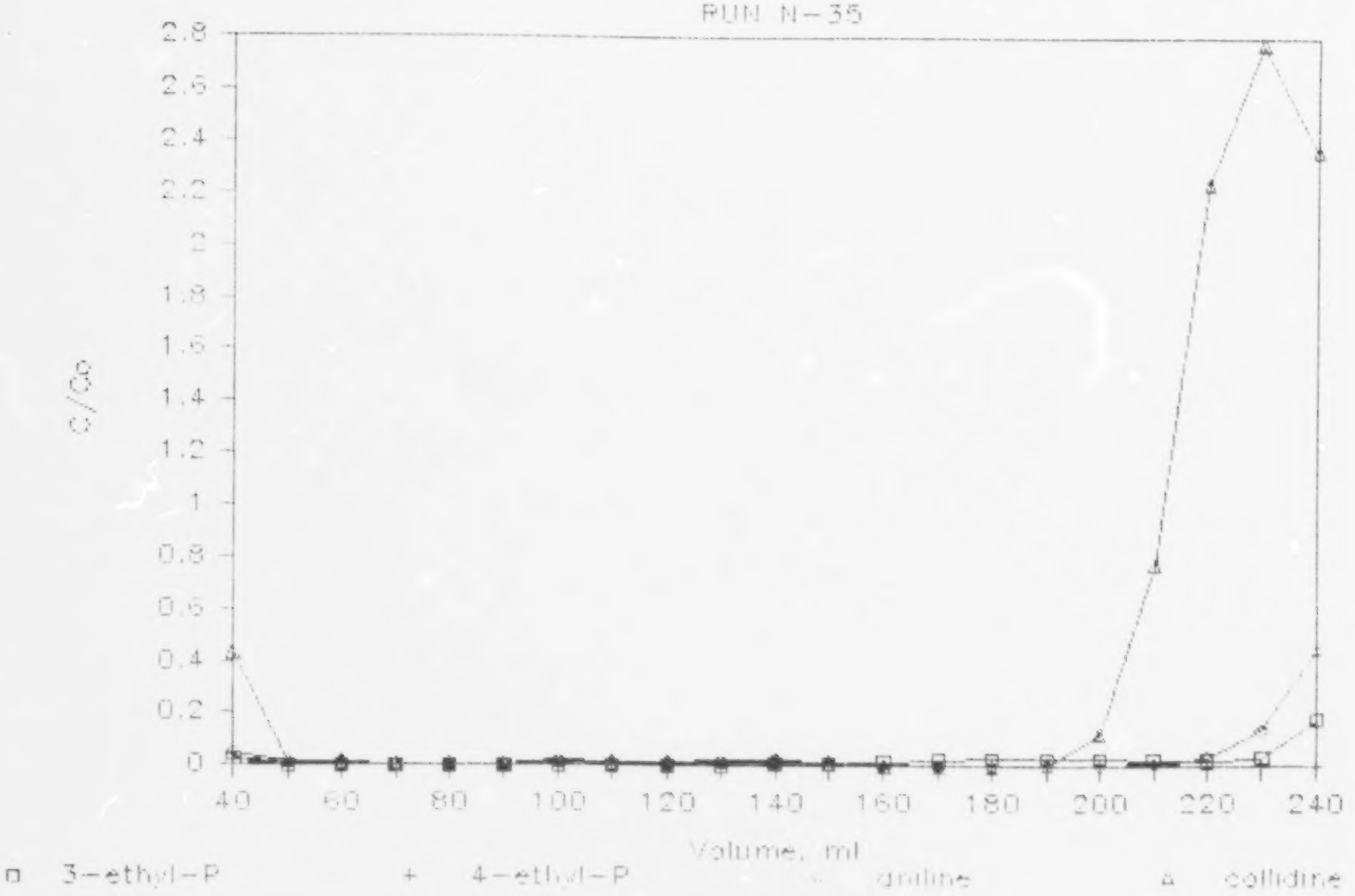
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-35



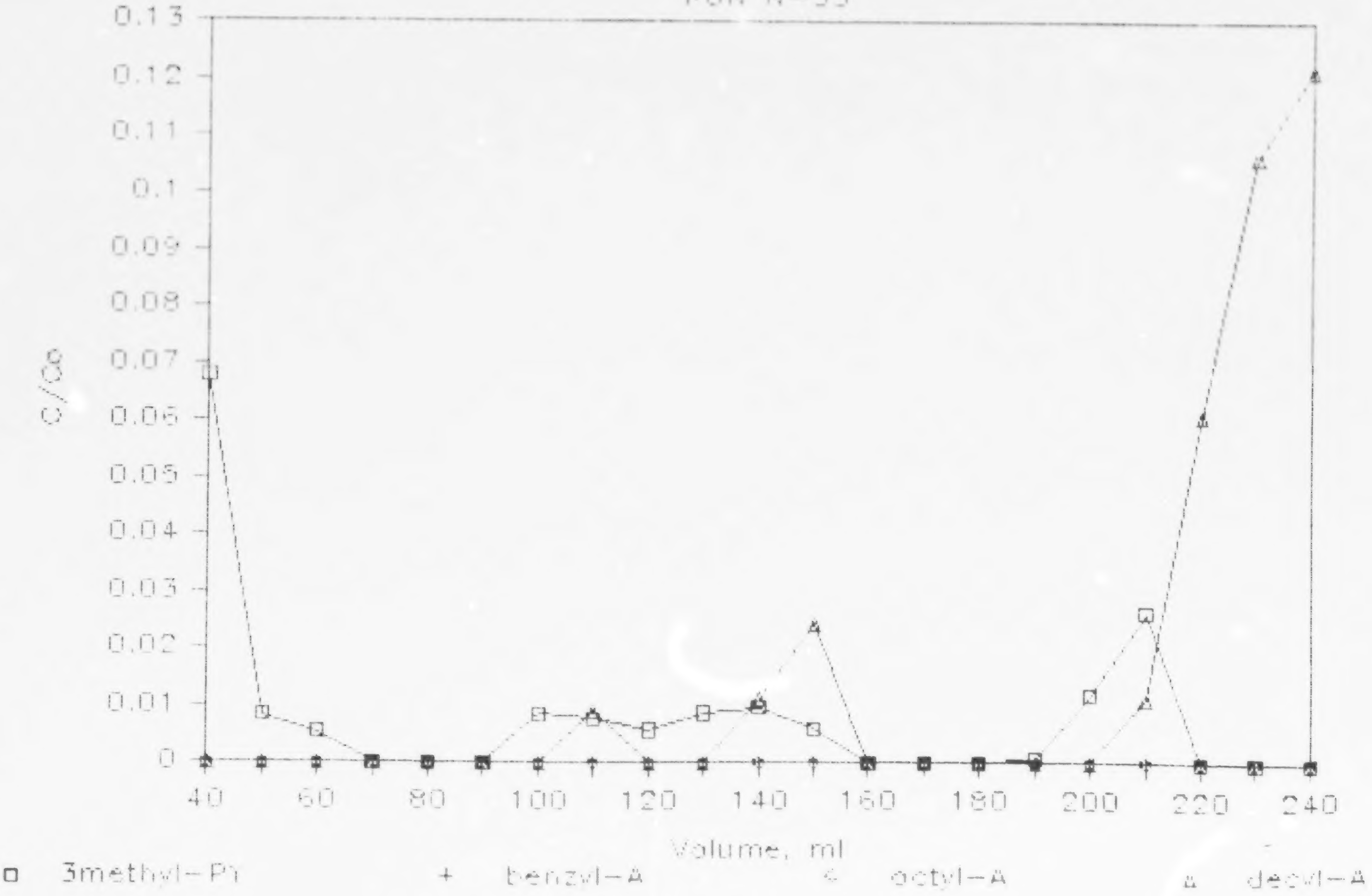
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-35

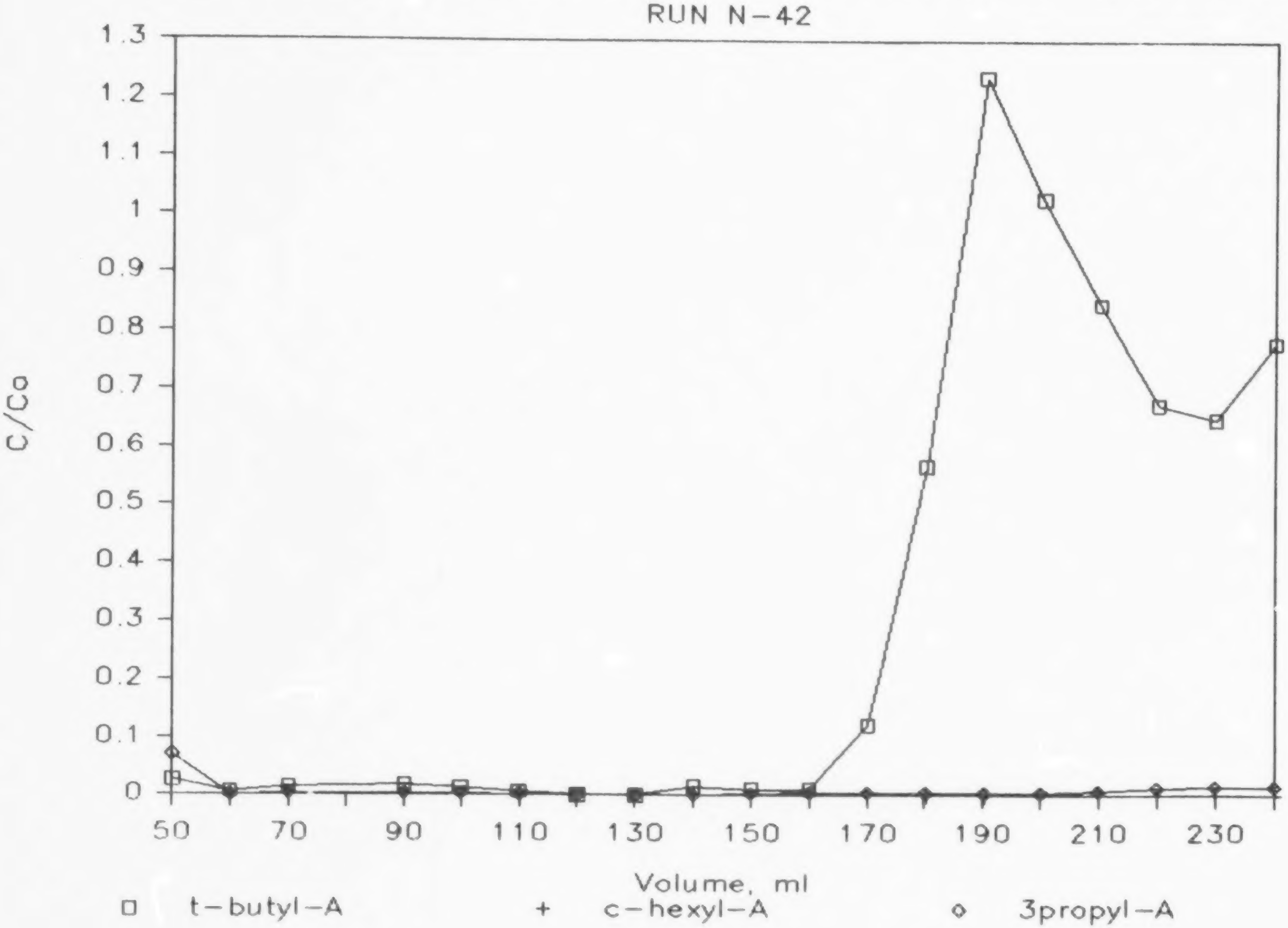


N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-35

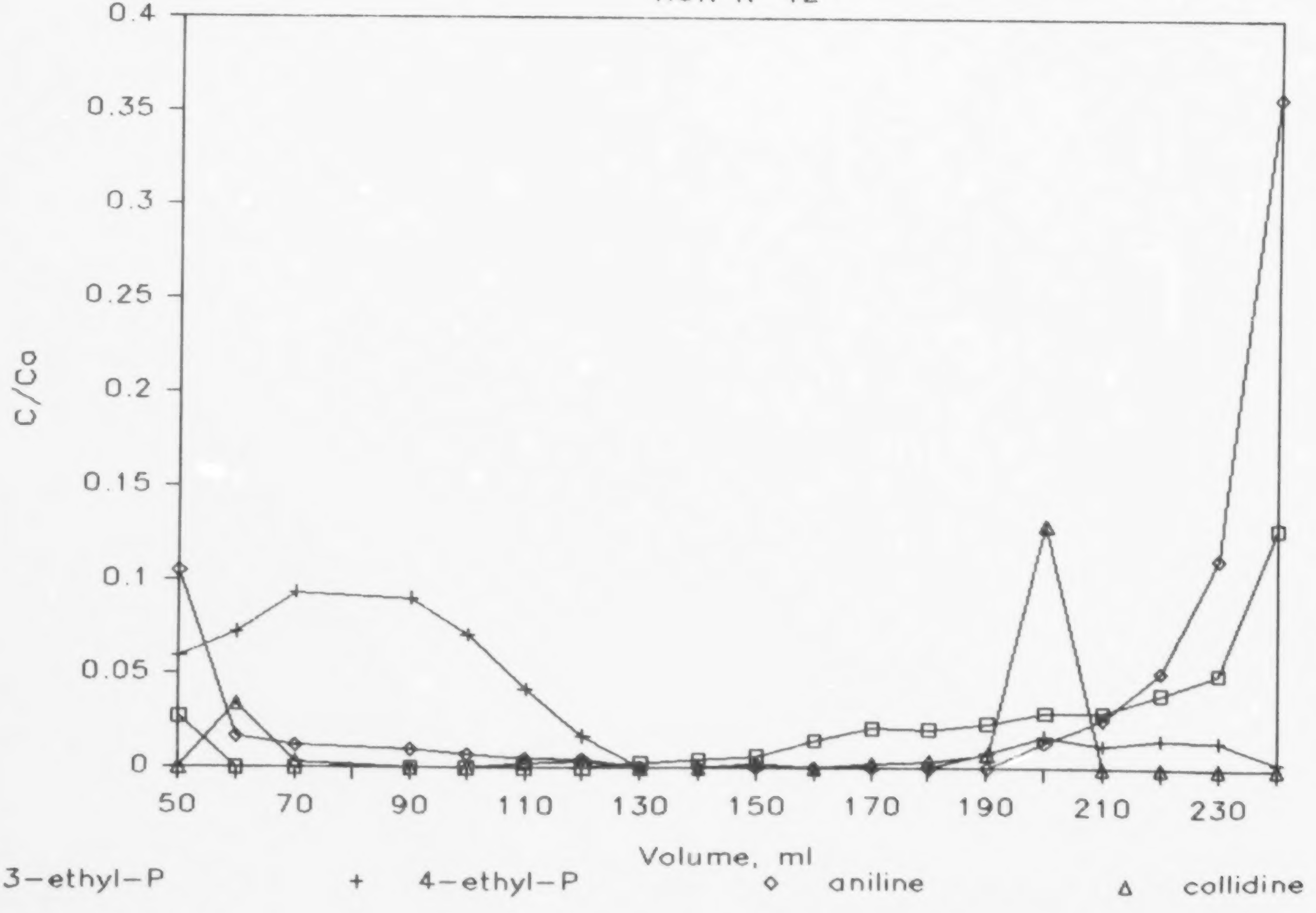


N-COMPOUNDS BREAKTHROUGH CURVES



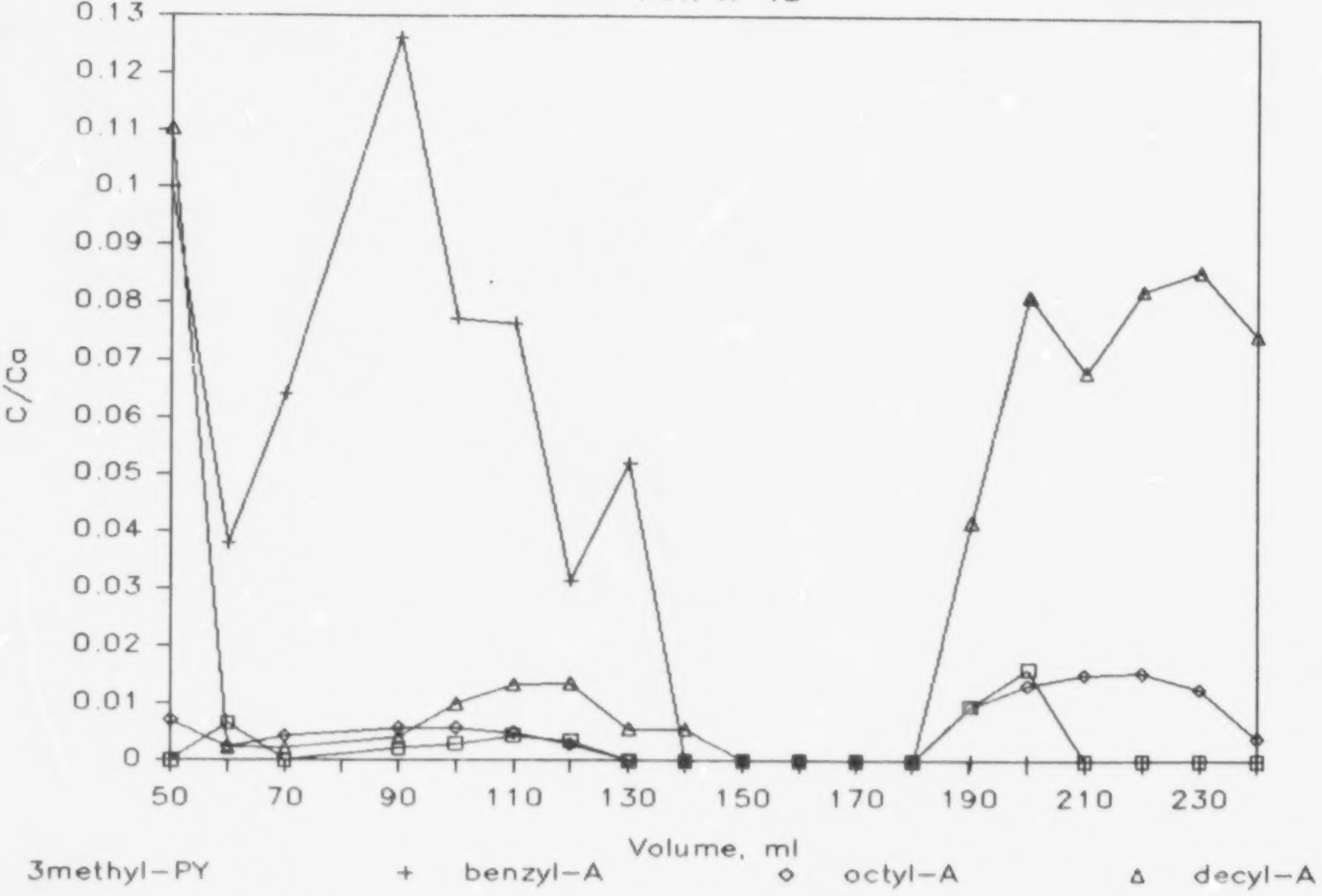
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-42



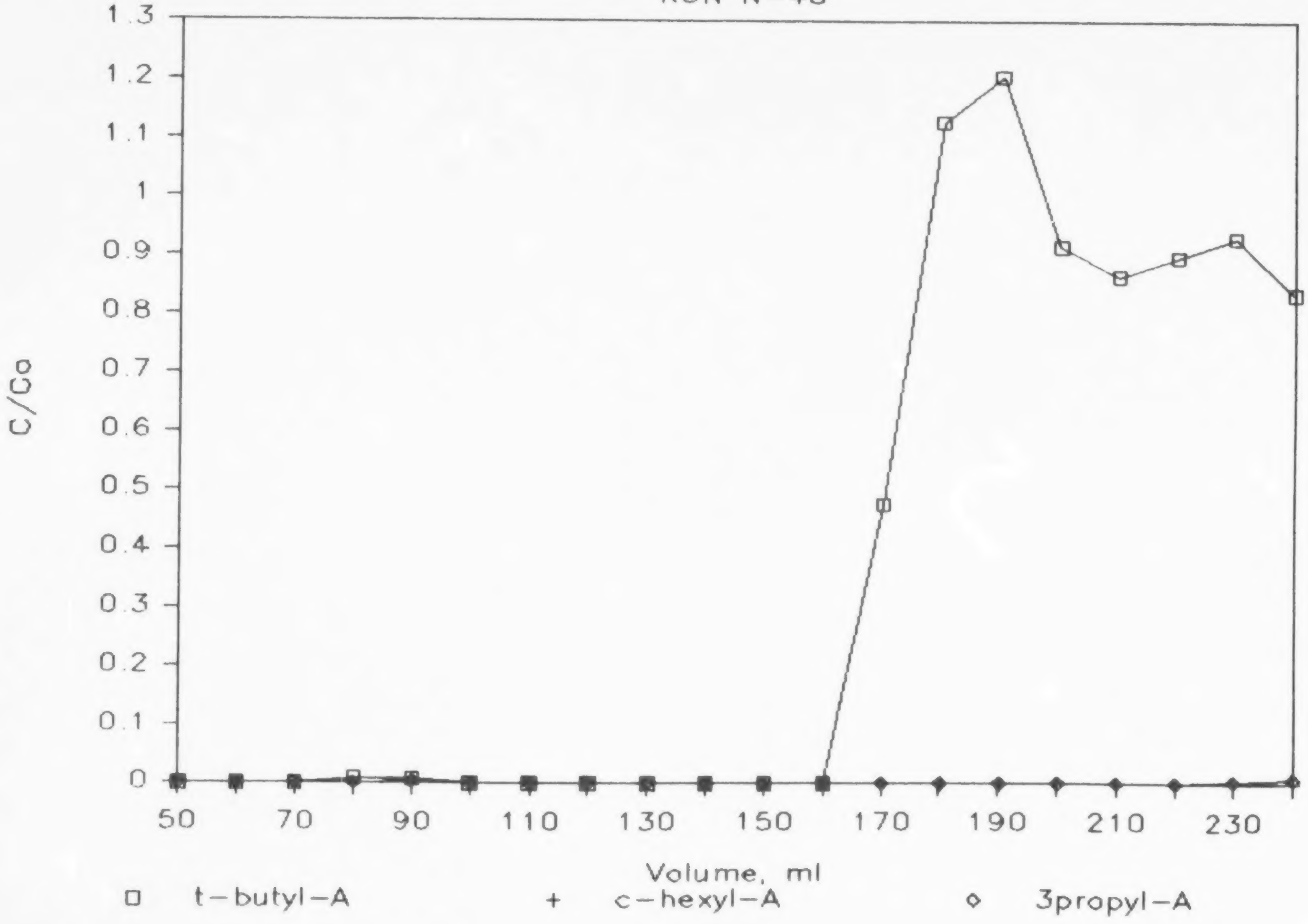
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-42



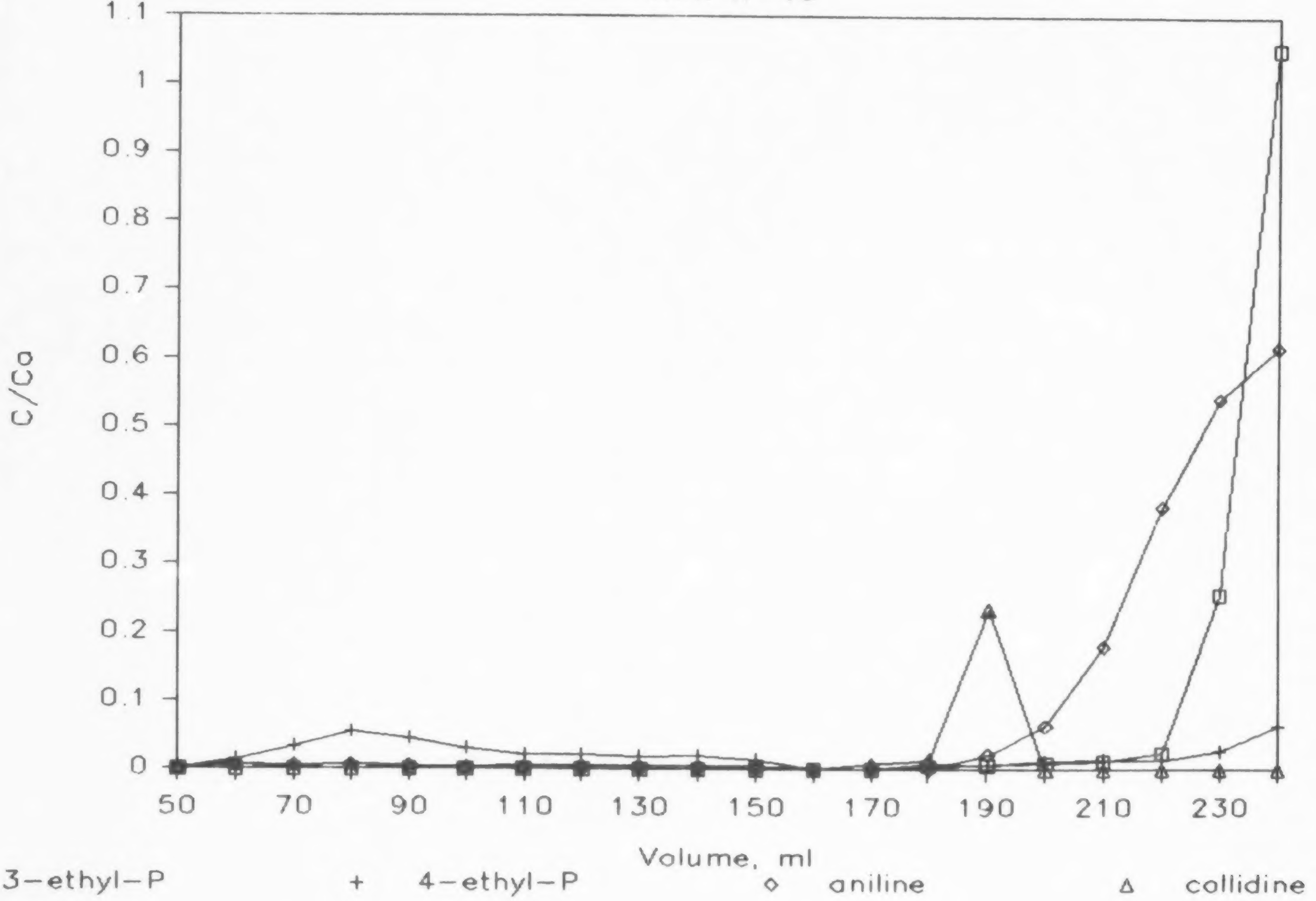
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–48



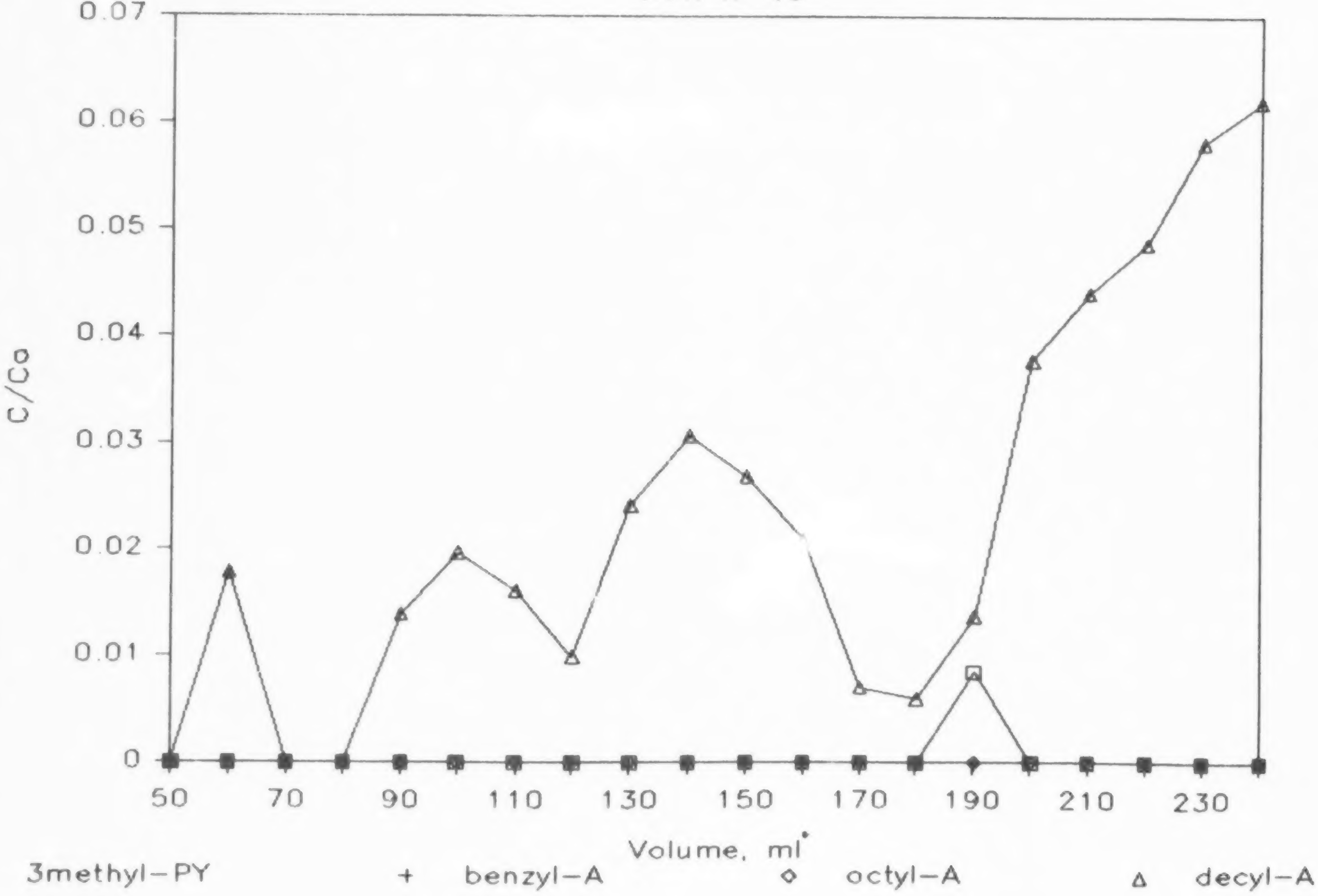
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-48



N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-48



Run N-43: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.0386297	0	0.0133669	0	0.0997377	0	0	0	0.00911948	0	0.290588
6	60	0	0	0	0	0	0.0111019	0.0146649	0	0	0	0
7	70	0	0	0	0	0	0.00563548	0.00741269	0	0	0	0
8	80	0	0	0	0	0	0.00497888	0.00667655	0	0	0	0
9	90	0	0	0	0	0	0	0.00215572	0	0	0	0
10	100	0	0	0	0	0	0	0	0	0	0	0
11	110	0	0	0	0	0	0	0.00251406	0	0	0	0
12	120	0	0	0	0	0	0	0.00343099	0	0	0	0
13	130	0	0	0	0	0	0.00712053	0.0112358	0	0	0	0
14	140	0	0	0	0	0	0.0064049	0.00840462	0	0	0	0
15	150	0	0	0	0	0	0.00582061	0.00878926	0	0	0	0
16	160	0	0	0	0	0	0.00564166	0.0105081	0	0	0	0
17	170	0	0	0	0	0	0.0065582	0.0126354	0	0	0	0
18	180	0	0	0.00707003	0	0	0	0.00808664	0	0	0	0
19	190	0.0772876	0	0.818716	0	0	0.0126237	0.0165508	0	0	0	0
20	200	0.258968	0	1.80253	0.0093955	0	0	0.0097084	0	0	0	0
21	210	0.558123	0	1.74455	0.0152001	0.00407647	0	0.0131433	0	0.00875701	0	0
22	220	0.519941	0	1.35816	0.0909069	0.0443645	0.00492914	0.0114228	0.050925	0.0130474	0.0433598	0.0263031
23	230	0.406149	0	1.22564	0.222309	0.147636	0.00689495	0.0136154	0.338466	0.0144252	0.443223	0.132888
24	240	0.39088	0	1.14771	0.200066	0.163474	0	0.0124152	0.672268	0.012228	0.906896	0.250401

Run N-44: 13 X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0.0129018	0	0.0330181	0.0310985	0.0368819	0.084692	0.151522	0.100089	0	0.12489	0.401794
5	50	0	0	0.00273103	0	0	0.0136363	0.0216312	0.0100672	0	0	0.0280178
6	60	0	0	0	0	0	0.00471954	0.00753784	0.00431368	0	0	0.00642622
7	70	0	0	0	0	0	0	0.00230938	0.00235355	0	0	0.00234509
8	80	0	0	0	0	0	0	0	0	0	0	0
9	90	0	0	0	0	0	0	0	0	0	0	0
10	100	0	0	0	0	0	0	0	0	0	0	0
11	110	0	0	0	0	0	0	0.00166033	0	0	0	0
12	120	0	0	0	0	0	0	0.00221462	0	0	0	0
13	130	0	0	0	0	0	0	0	0	0	0	0
14	140	0	0	0	0.00288504	0	0	0.00348761	0	0	0	0
15	150	0.0154852	0	0	0.00468289	0	0	0.00557994	0	0	0	0
16	160	0.170713	0	0.244039	0.00602872	0	0	0.00710879	0	0	0	0
17	170	0.236527	0	0.605491	0.006227	0	0	0.00692641	0	0	0	0.0146824
18	180	0.218893	0	0.708297	0.00713914	0	0.0316495	0.0135744	0	0.0105119	0.0927568	0.0332778

Run N-45: 13 X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

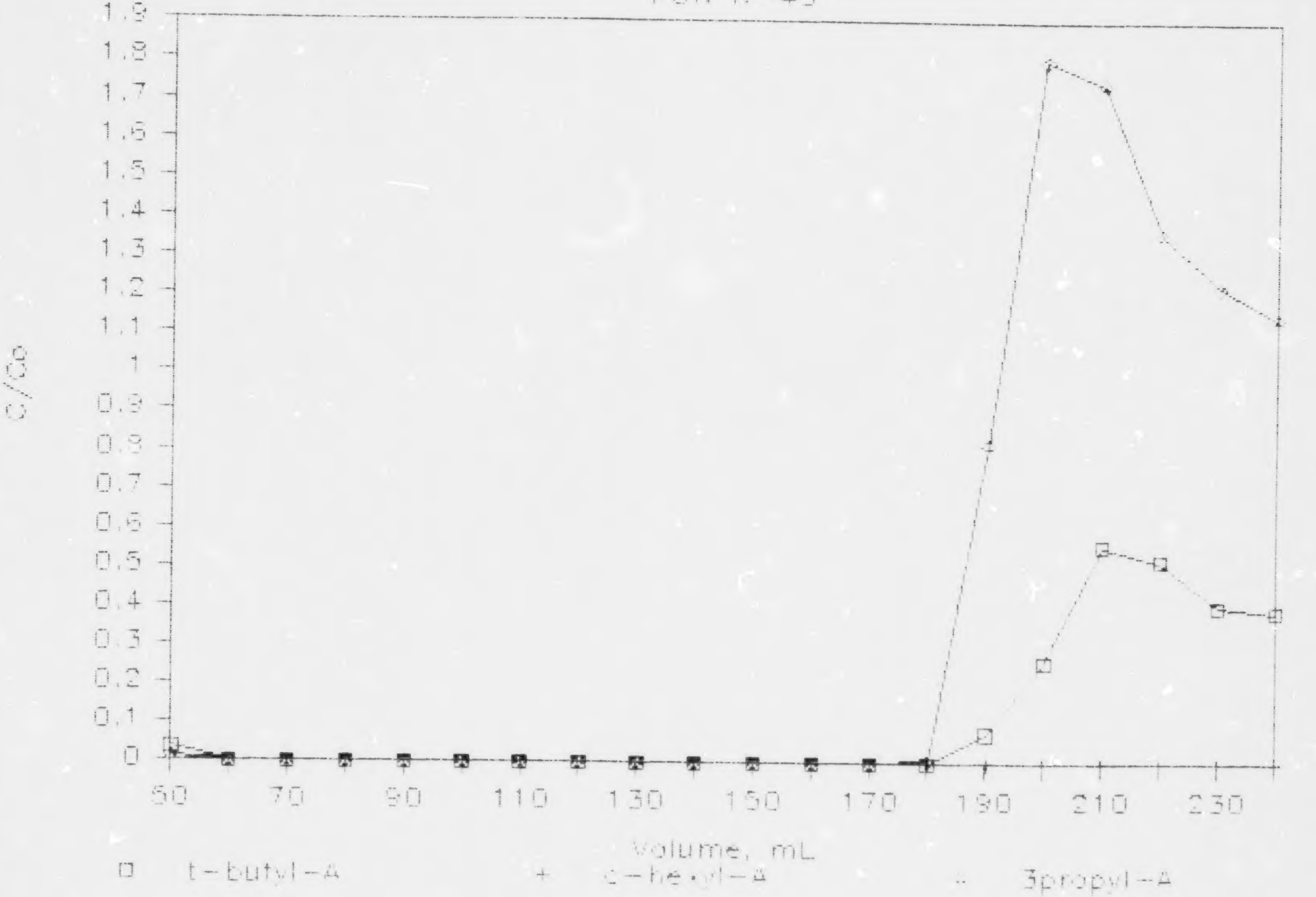
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0	0	0.017058	0.025263	0	0	0	0
6	60	0	0	0	0	0	0	0	0	0	0	0
7	70	0	0	0	0	0	0	0	0	0	0	0
8	80	0	0	0	0	0	0	0	0	0	0	0
9	90	0	0	0	0	0	0	0	0	0	0	0
10	100	0	0	0	0	0	0	0	0	0	0	0
11	110	0	0	0	0	0	0	0	0	0	0	0
12	120	0	0	0	0	0	0	0	0	0	0	0

Run N-46: 13 X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0.05172	0.051671	0.062139	0.116182	0.202623	0.052255	0	0.041977	0.037166
5	50	0	0	0	0	0	0.012913	0.01981	0	0	0	0
6	60	0	0	0	0	0	0.008424	0.010874	0	0	0	0

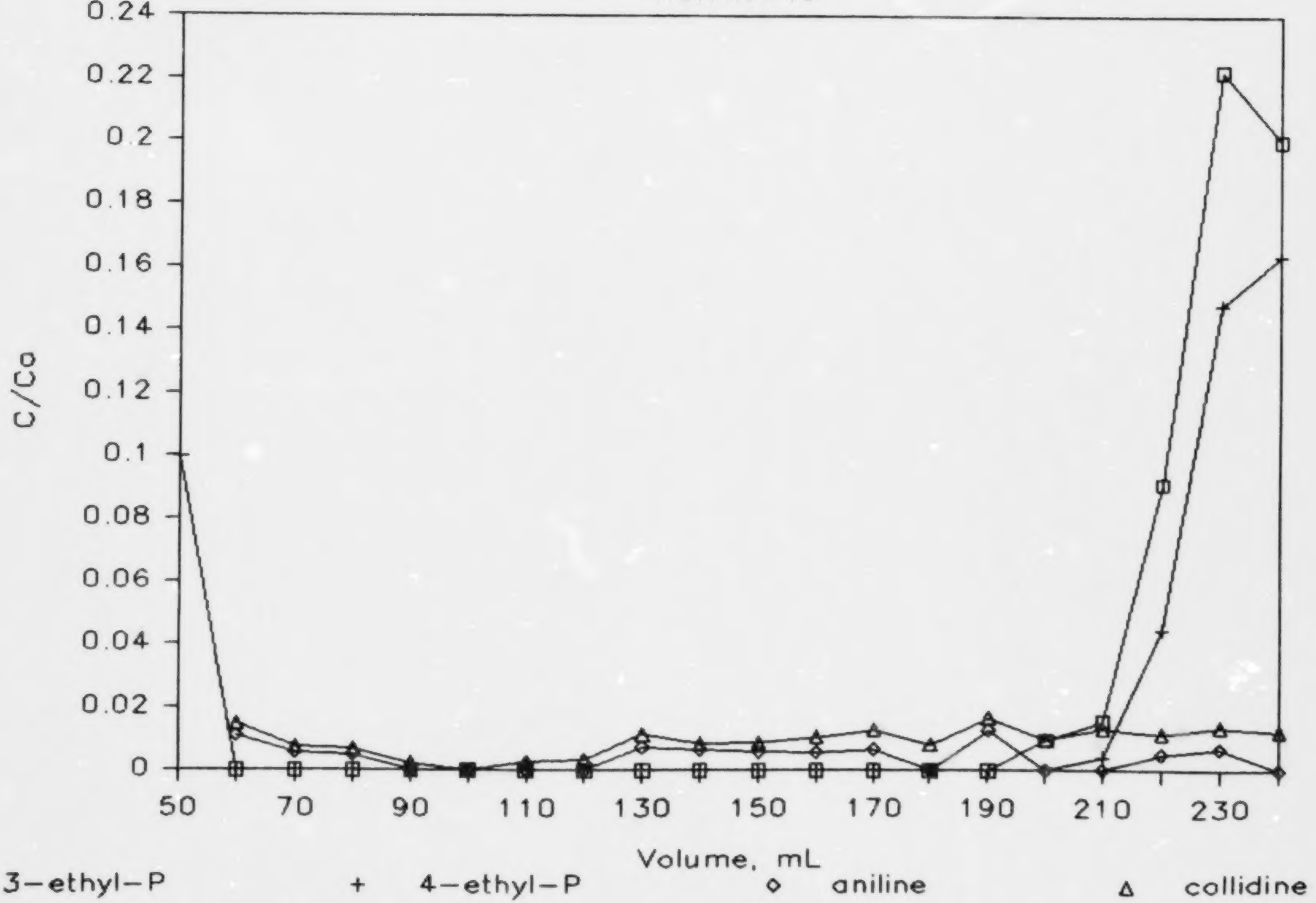
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-43



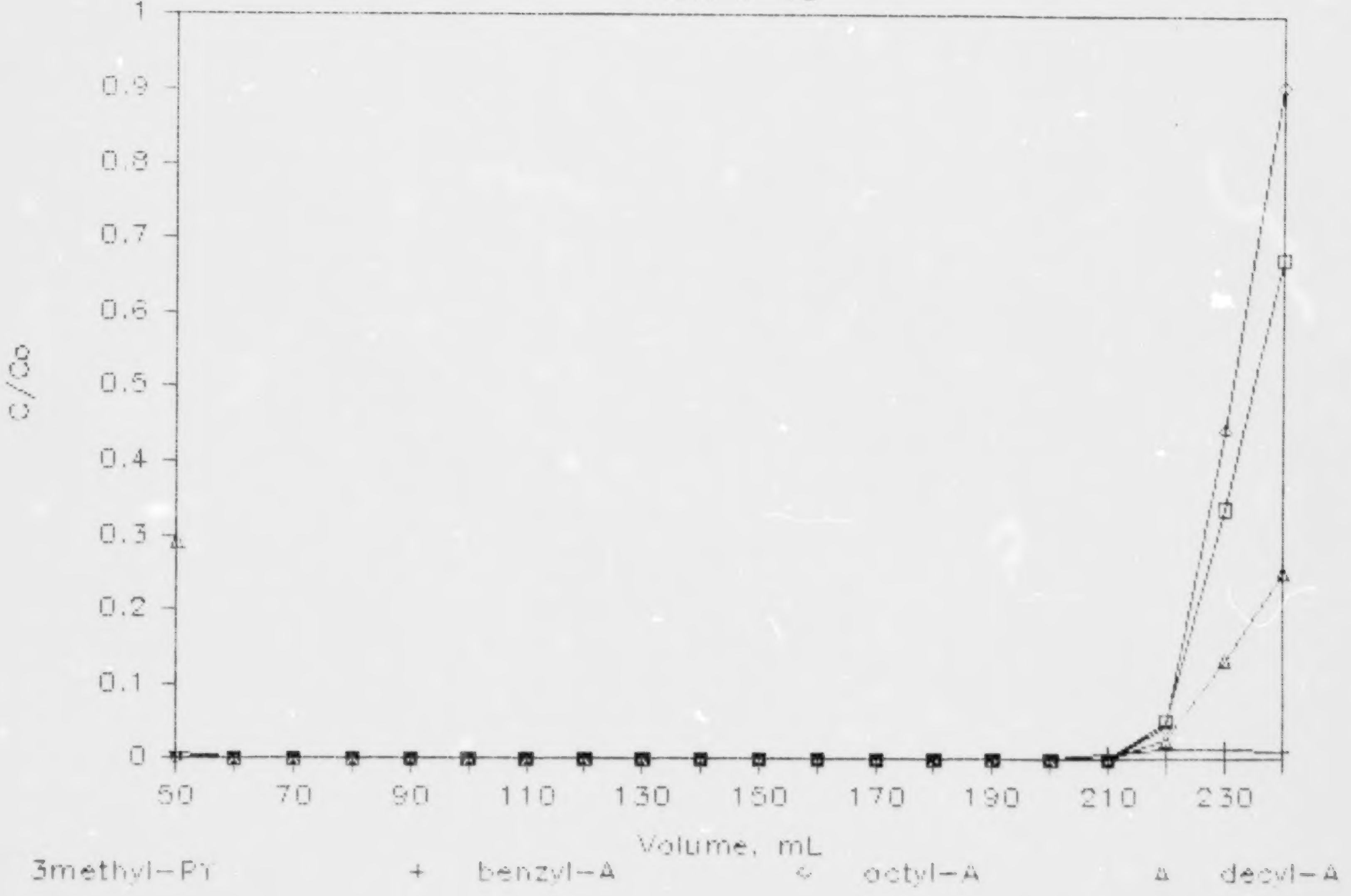
N-COMPOUNDS BREAKTHROUGH CURVES

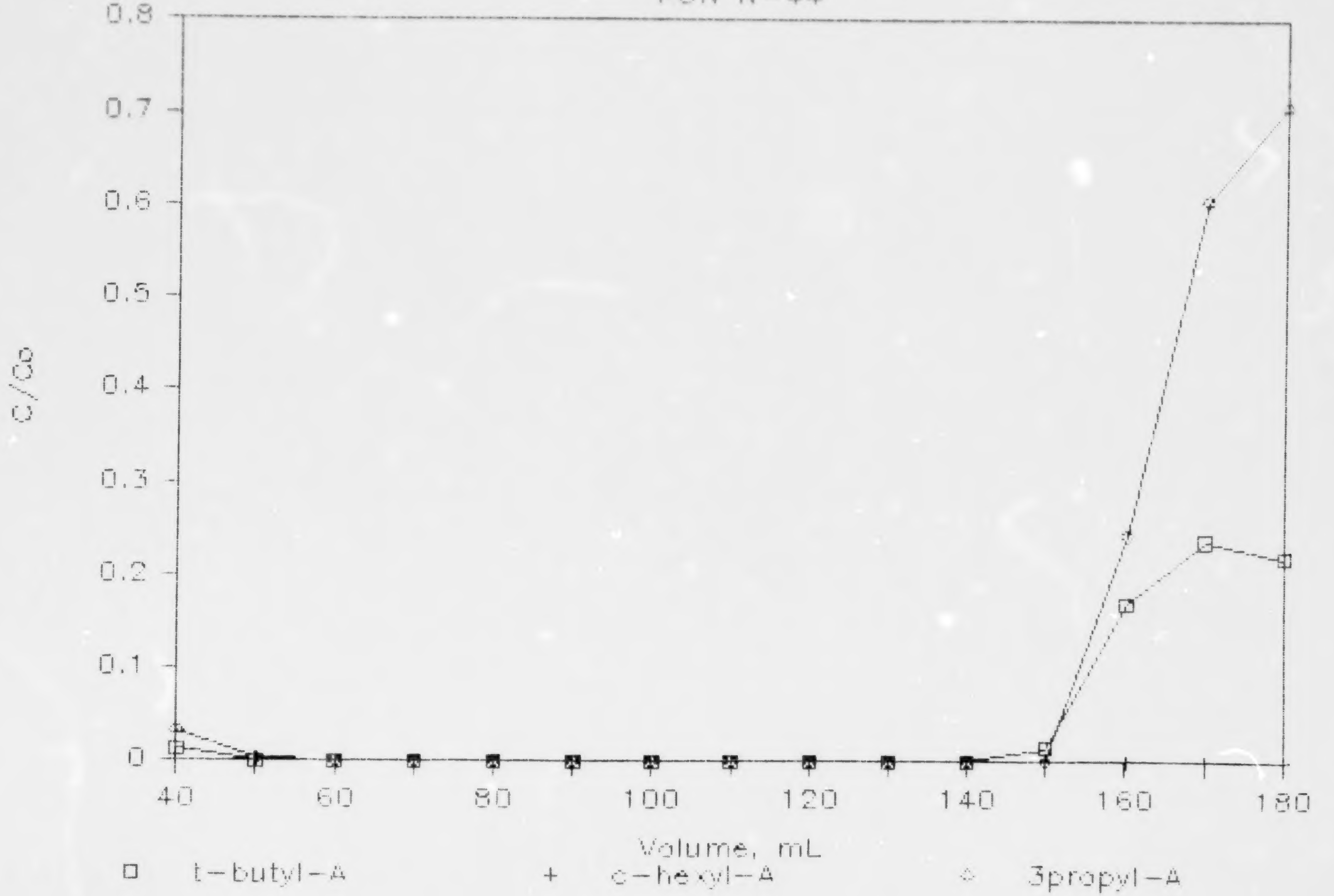
RUN N-43



N—COMPOUNDS BREAKTHROUGH CURVES

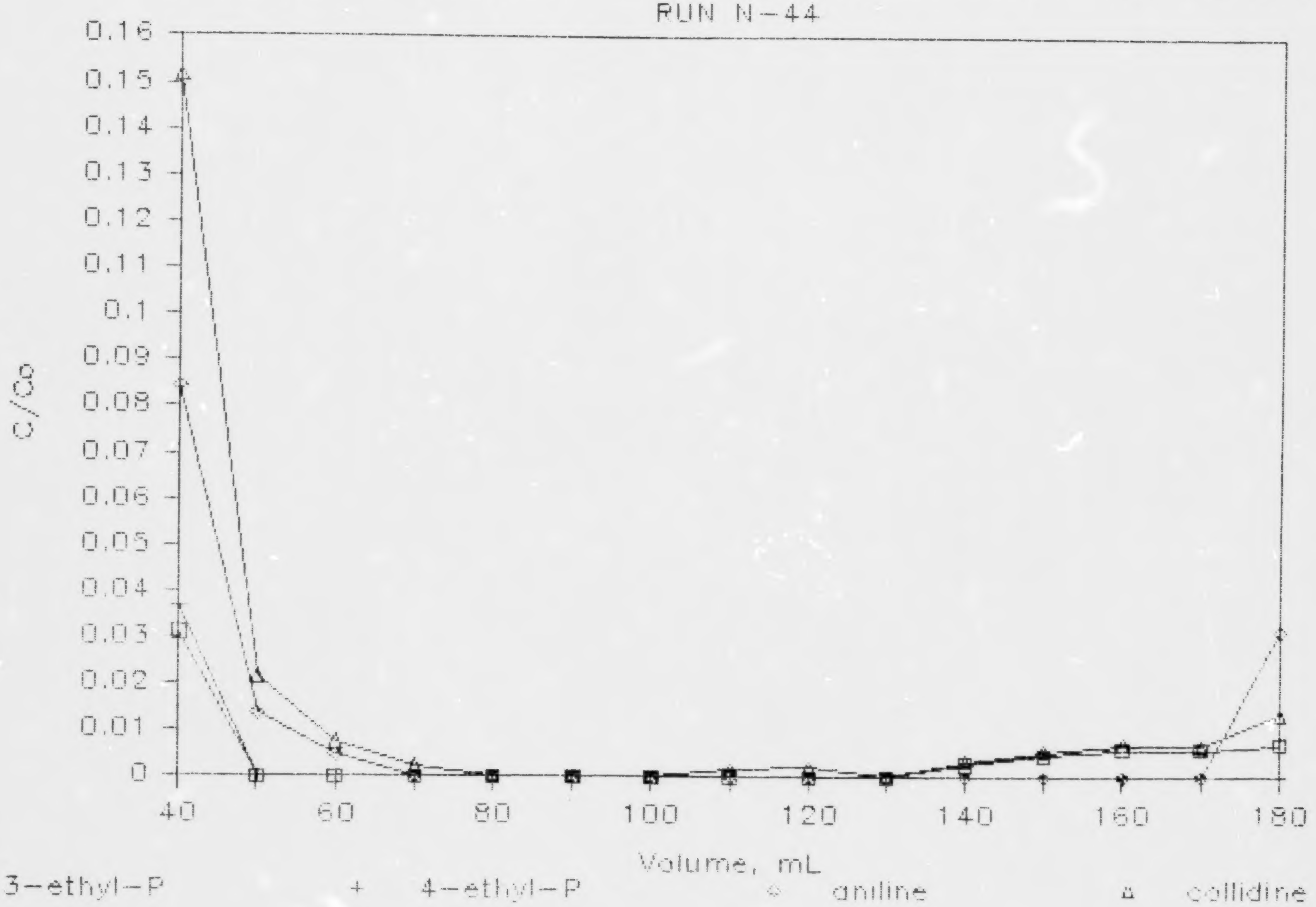
RUN N—43




N-COMPOUNDS BREAKTHROUGH CURVES

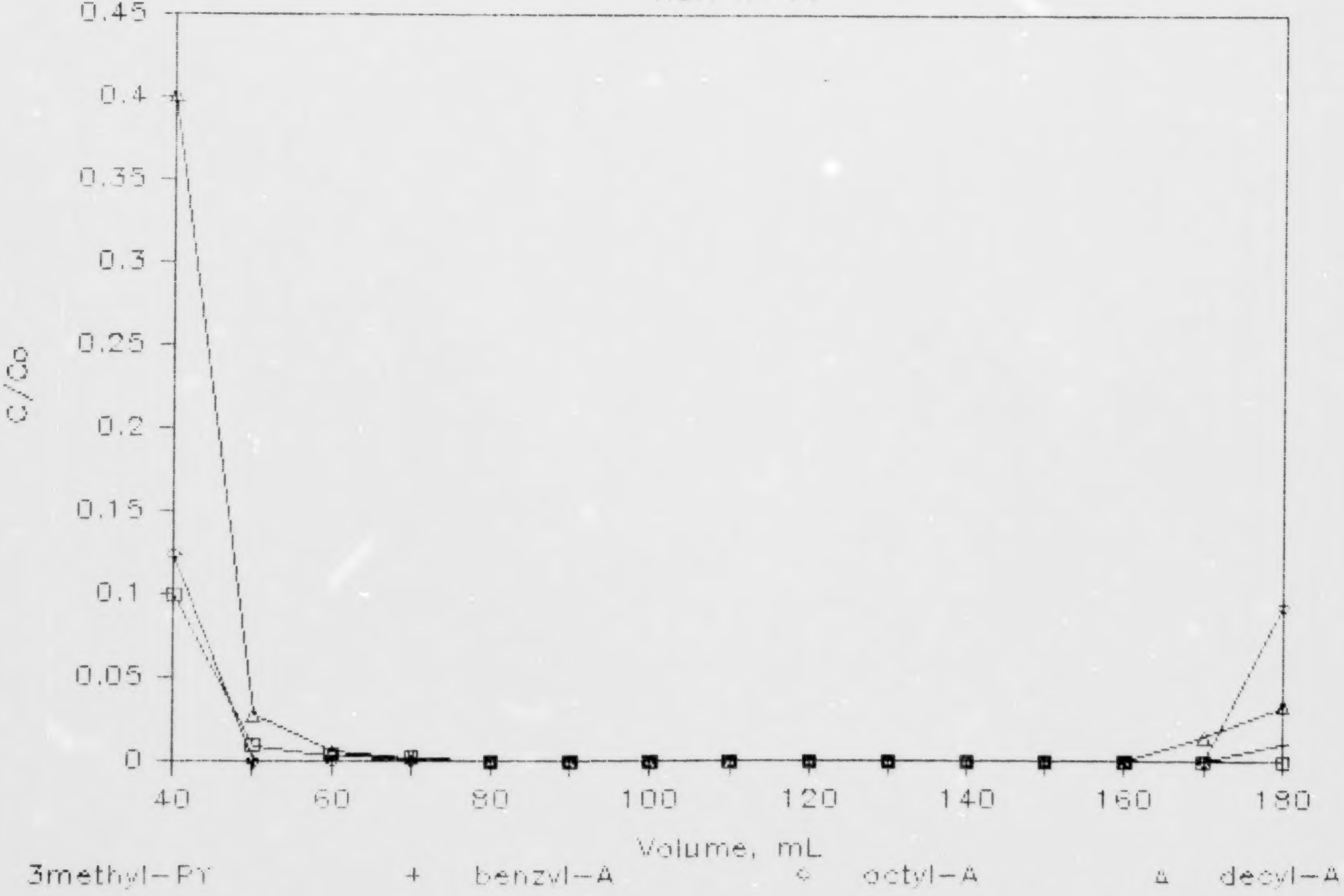
RUN N-44

N-COMPOUNDS BREAKTHROUGH CURVES



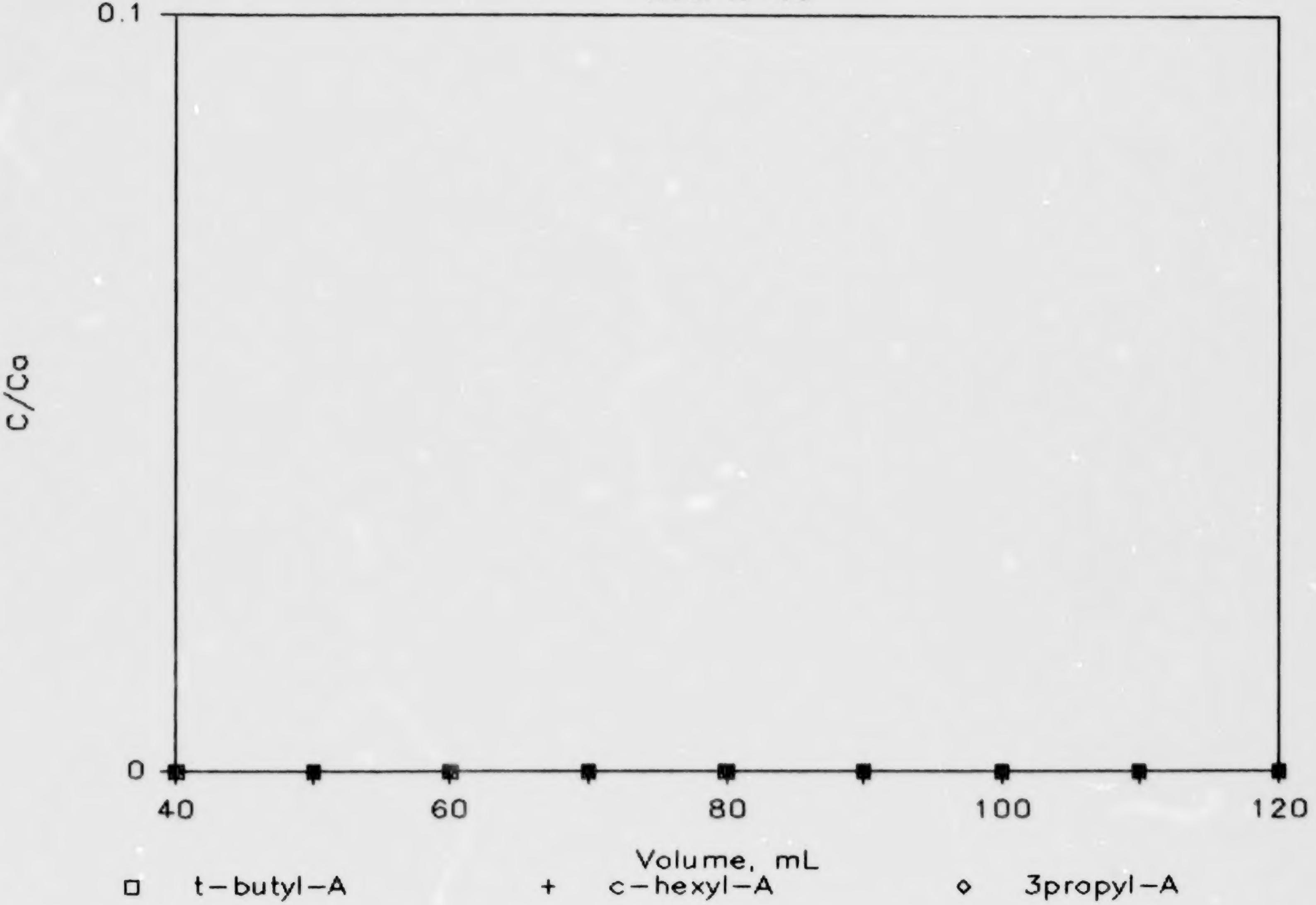
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-44



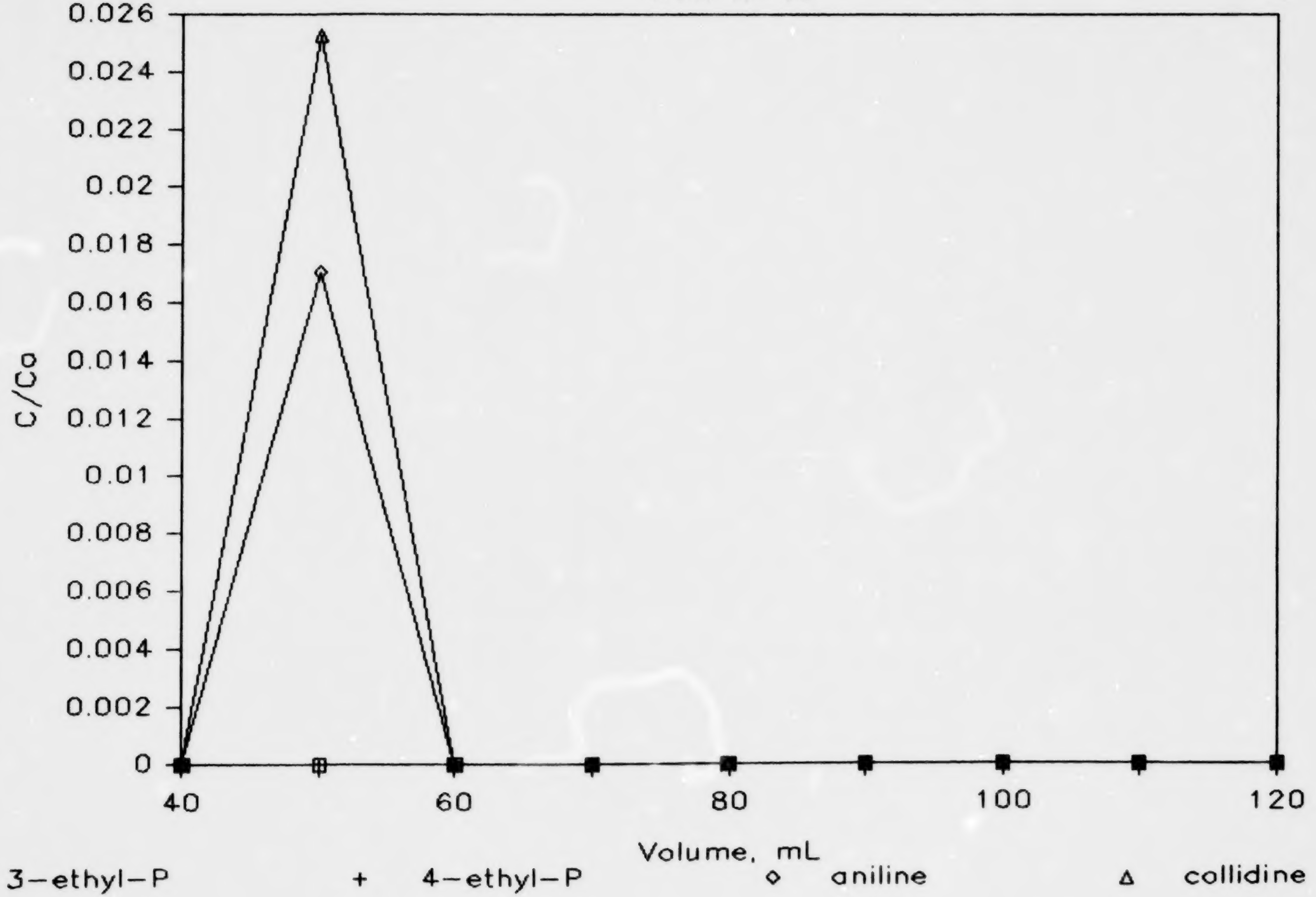
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-45



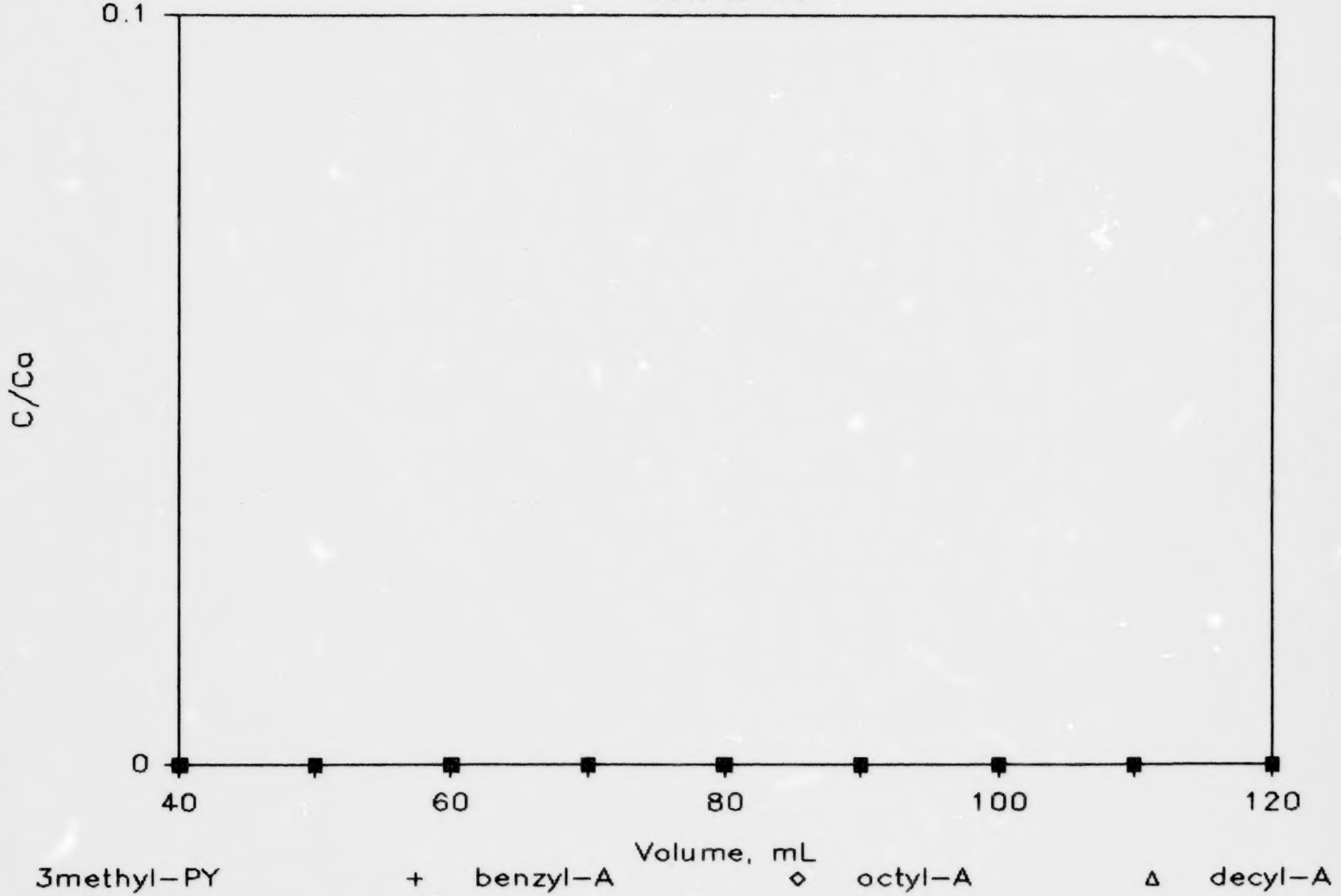
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-45



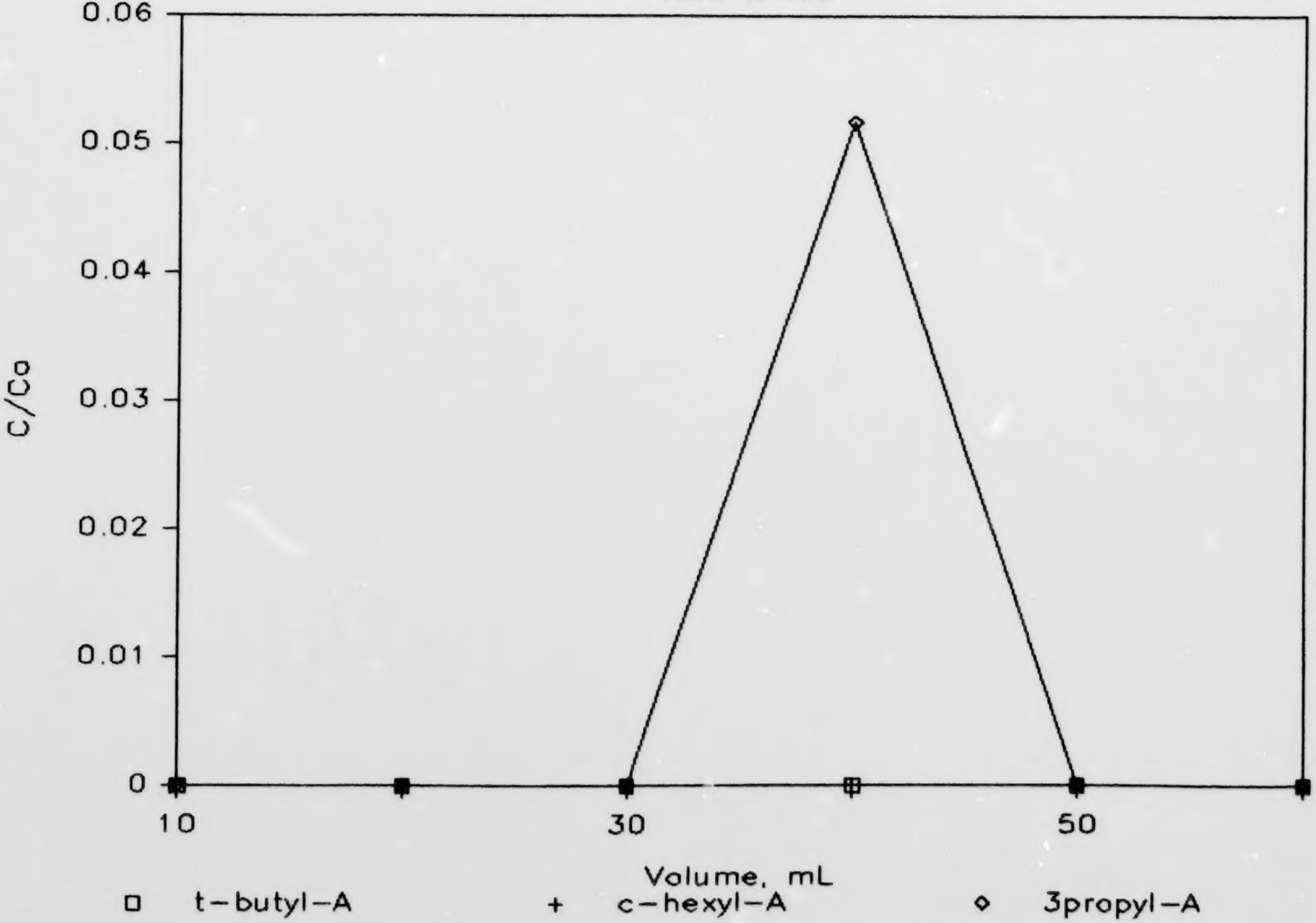
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–45



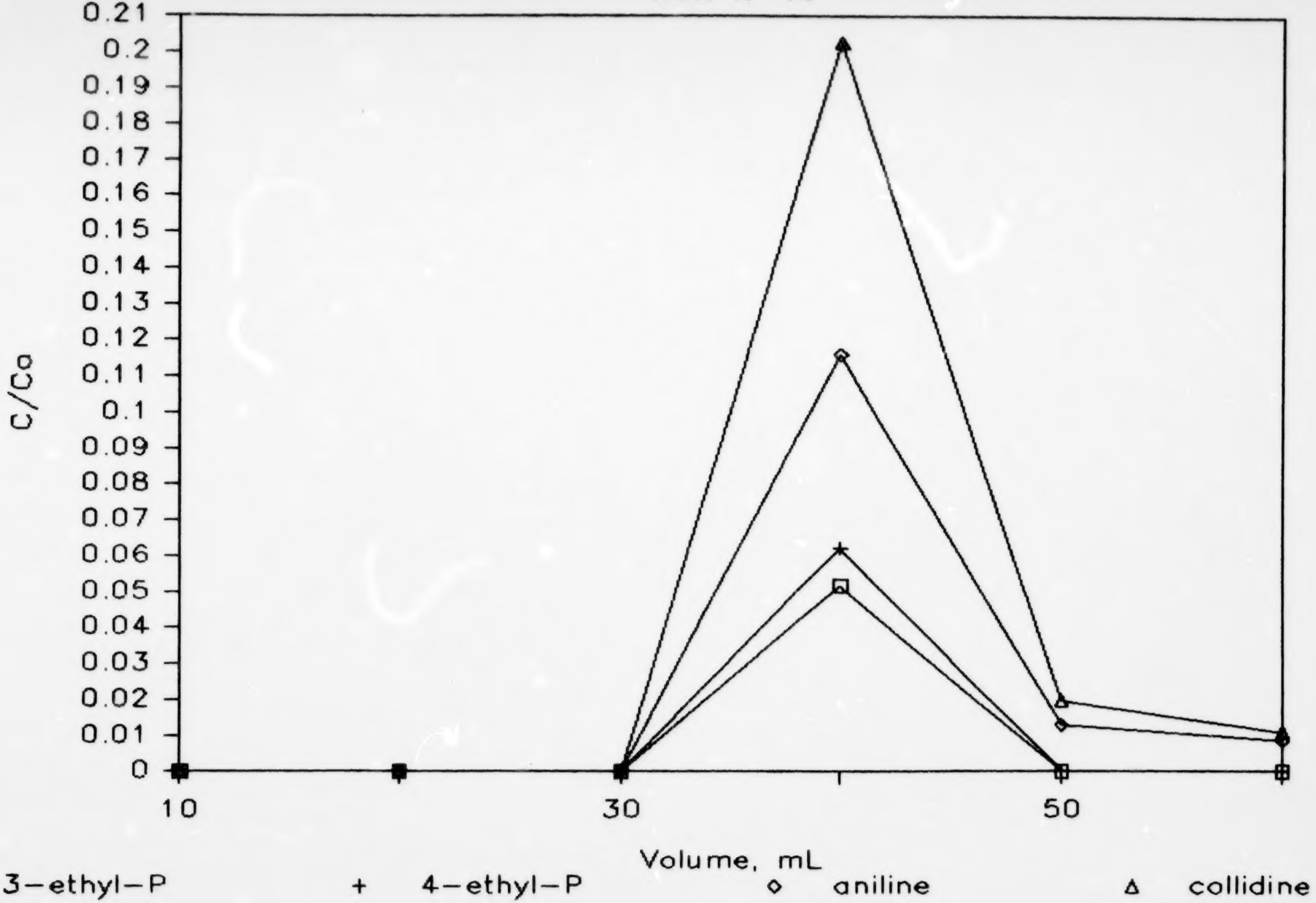
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–46



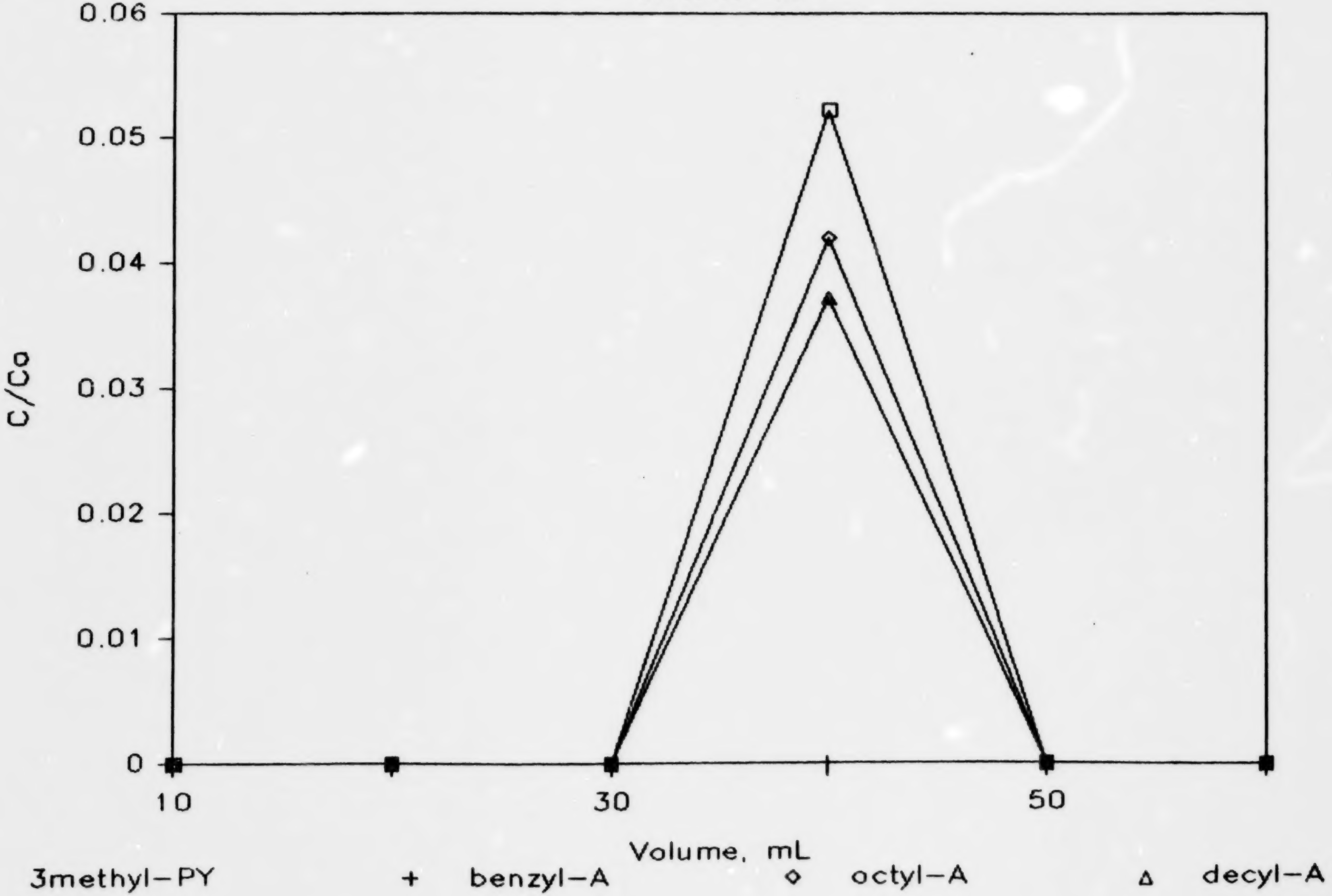
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-46



N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–46



Run N-49: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Esso
Run N-50: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Naphtha-Esso
Run N-51: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Syncrude
Run N-52: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Naphtha-Syncrude
Run N-53: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Gulf
Run N-54: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Naphtha-Gulf
Run N-55: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Suncor

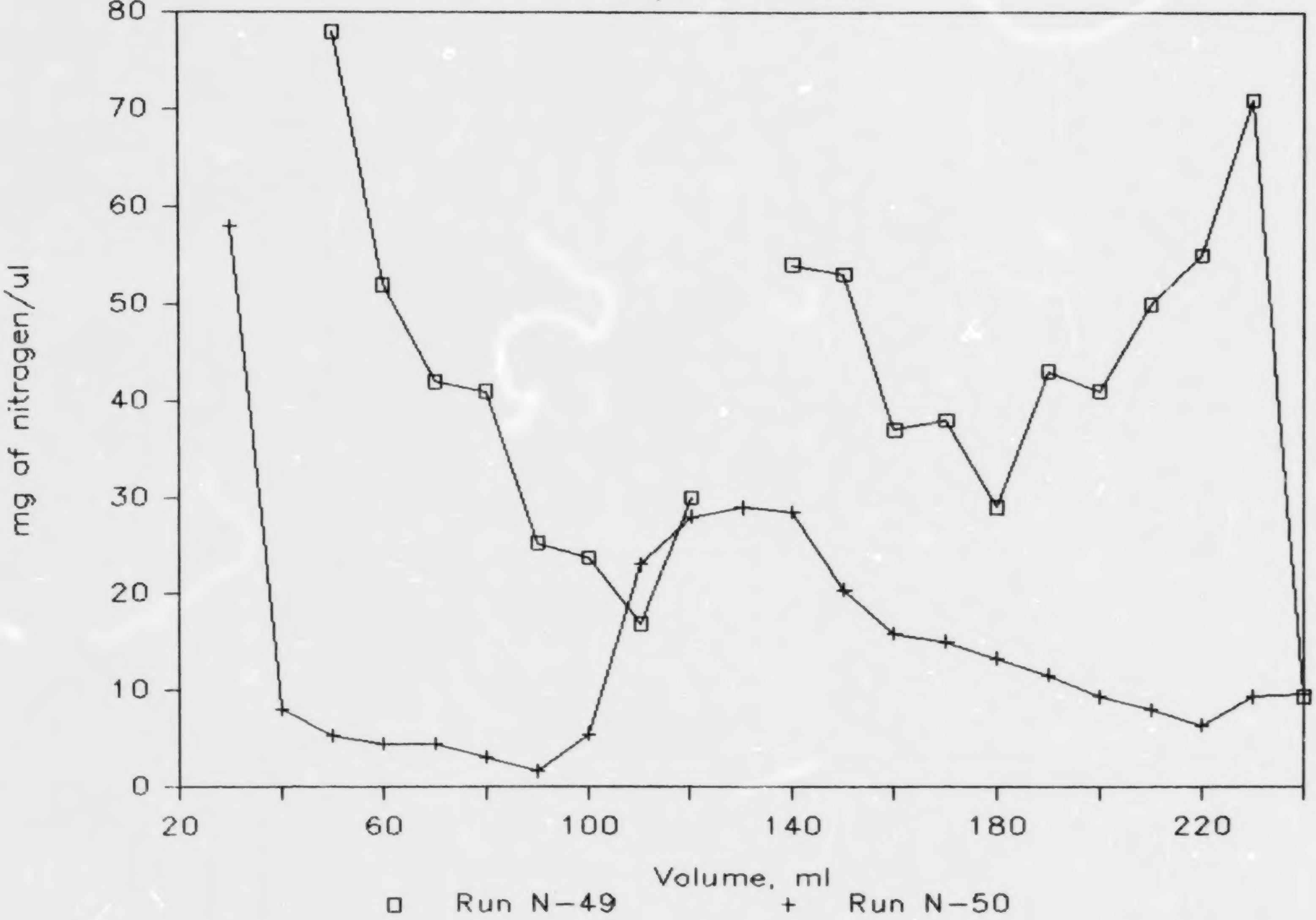
					mg of nitrogen/ul			
#	ml	N-49	N-50	N-51	N-52	N-53	N-54	N-55
1	10							
2	20					88		
3	30		58			10.7		
4	40		8		45	6.6	28	
5	50	78	5.2	40	16.5	5.8	25	
6	60	52	4.4	4.8	4.4	6.2	6.6	
7	70	42	4.4	2.4	11.5	3.4	3.8	
8	80	41	3	1.6	26	3	1.4	42.7
9	90	25.2	1.6	4.2	22.5	2	2.4	24.4
10	100	23.7	5.4	7	13.7	3.6	4.6	9.2
11	110	16.8	23	7.4	8.8	2.4	7	13.4
12	120	30	28	10.2	8.4	1.8	9.6	5.8
13	130		29	7.2	8.4	2.2	11.8	3.4
14	140	54	28.5	7.8	8.8	1.6	14.7	7.5
15	150	53	20.3	7.2	10.4	1.8	19.2	7.6
16	160	37	15.8		12.8	2.6	27	3.8
17	170	38	15	9.6	11	2	24.7	4.2
18	180	29	13.3	10	11	2	18.3	3.8
19	190	43	11.6	18.8	10.2	1.8	19.6	9.2
20	200	41	9.4	14.7	13.4	1.2	19.6	30.4
21	210	50	8	14.5	14.4	1.4	14.4	8.2
22	220	55	6.4	15.3	15.4	2	14.2	6.8
23	230	71	9.4	15	15.6	5.2	21.6	10.2
24	240	9.4	9.6	14.4	19.5	2.4	29.5	7.7

Run N-49: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Esso
Run N-50: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Naphtha-Esso
Run N-51: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Syncrude
Run N-52: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Naphtha-Syncrude
Run N-53: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Gulf
Run N-54: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Naphtha-Gulf
Run N-55: 13X, 1 ml/min, 15 psi, 250 C, Naphtha-Suncor

		mg of nitrogen/ul						
#	ml	N-49	N-50	N-51	N-52	N-53	N-54	N-55
1	10	0	0	0	0	0	0	0
2	20	0	0	0	0	88	0	0
3	30	0	58	0	0	10.7	0	0
4	40	0	8	0	45	6.6	28	0
5	50	78	5.2	40	16.5	5.8	25	0
6	60	52	4.4	4.8	4.4	6.2	6.6	0
7	70	42	4.4	2.4	11.5	3.4	3.8	0
8	80	41	3	1.6	26	3	1.4	42.7
9	90	25.2	1.6	4.2	22.5	2	2.4	24.4
10	100	23.7	5.4	7	13.7	3.6	4.6	9.2
11	110	16.8	23	7.4	8.8	2.4	7	13.4
12	120	30	28	10.2	8.4	1.8	9.6	5.8
13	130		29	7.2	8.4	2.2	11.8	3.4
14	140	54	28.5	7.8	8.8	1.6	14.7	7.5
15	150	53	20.3	7.2	10.4	1.8	19.2	7.6
16	160	37	15.8		12.8	2.6	27	3.8
17	170	38	15	9.6	11	2	24.7	4.2
18	180	29	13.3	10	11	2	18.3	3.8
19	190	43	11.6	18.8	10.2	1.8	19.6	9.2
20	200	41	9.4	14.7	13.4	1.2	19.6	30.4
21	210	50	8	14.5	14.4	1.4	14.4	8.2
22	220	55	6.4	15.3	15.4	2	14.2	6.8
23	230	71	9.4	15	15.6	5.2	21.6	10.2
24	240	9.4	9.6	14.4	19.5	2.4	29.5	7.7

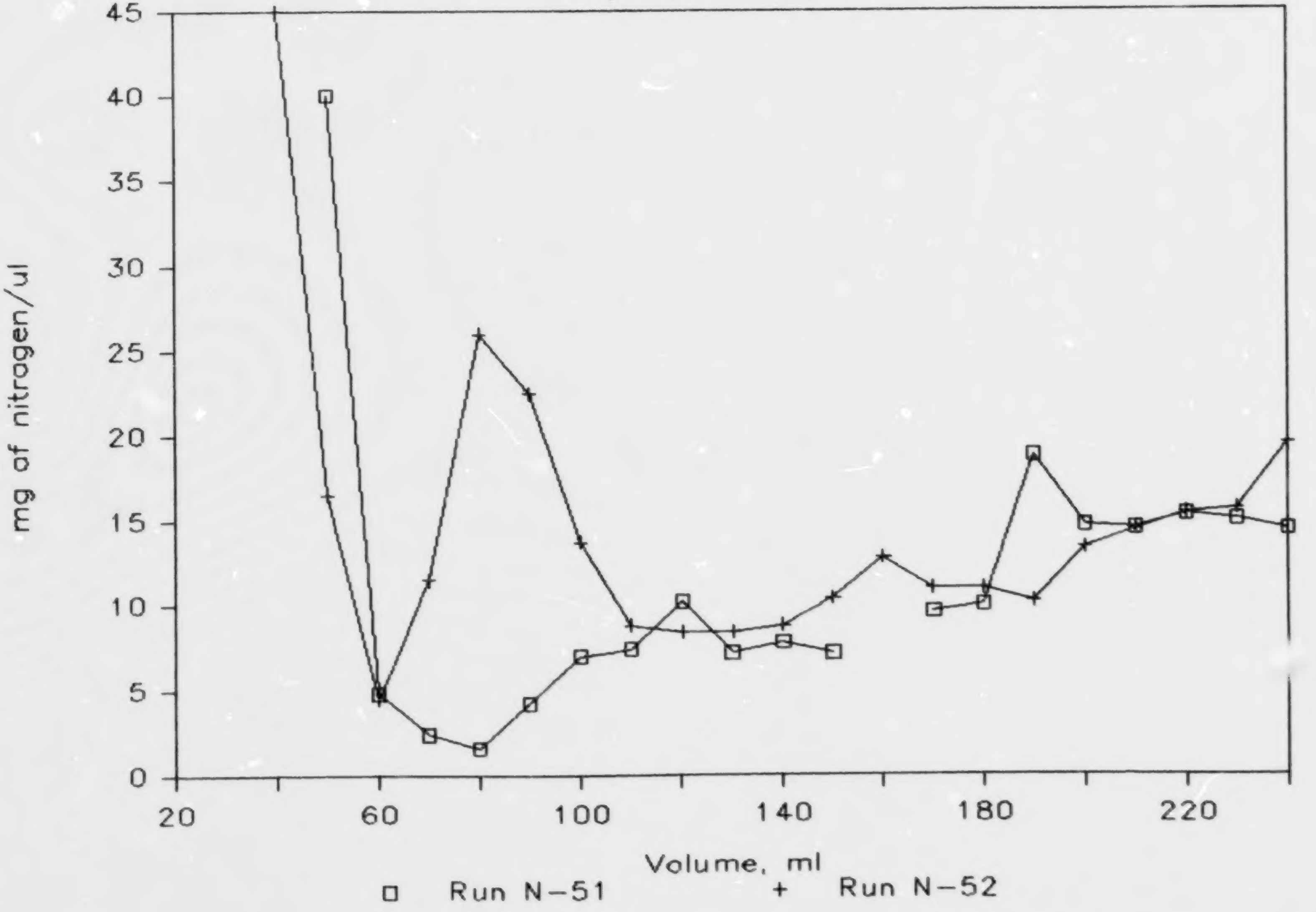
TOTAL NITROGEN BREAKTHROUGH CURVES

Naphtha – Esso



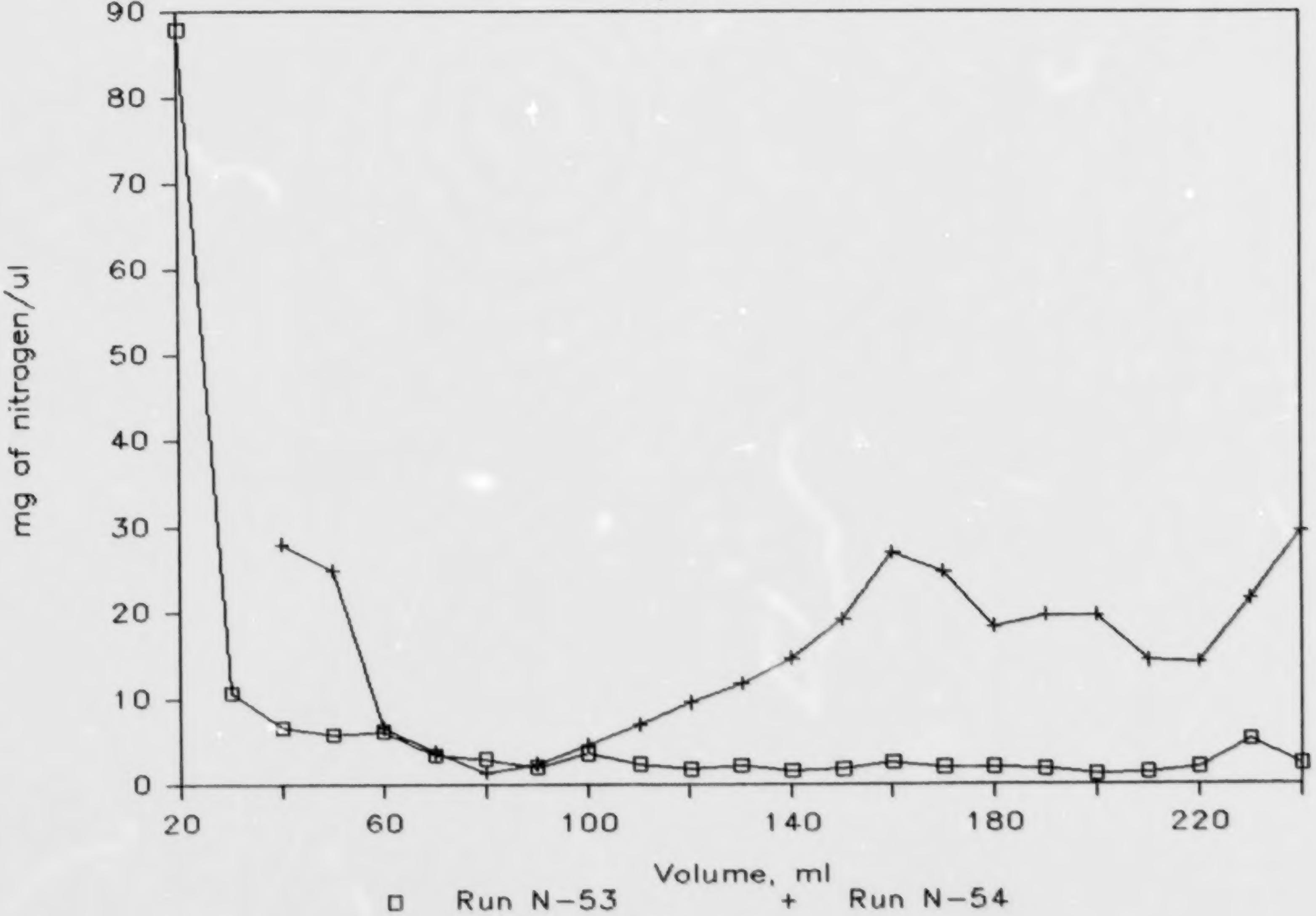
TOTAL NITROGEN BREAKTHROUGH CURVES

Naphtha – Syncrude

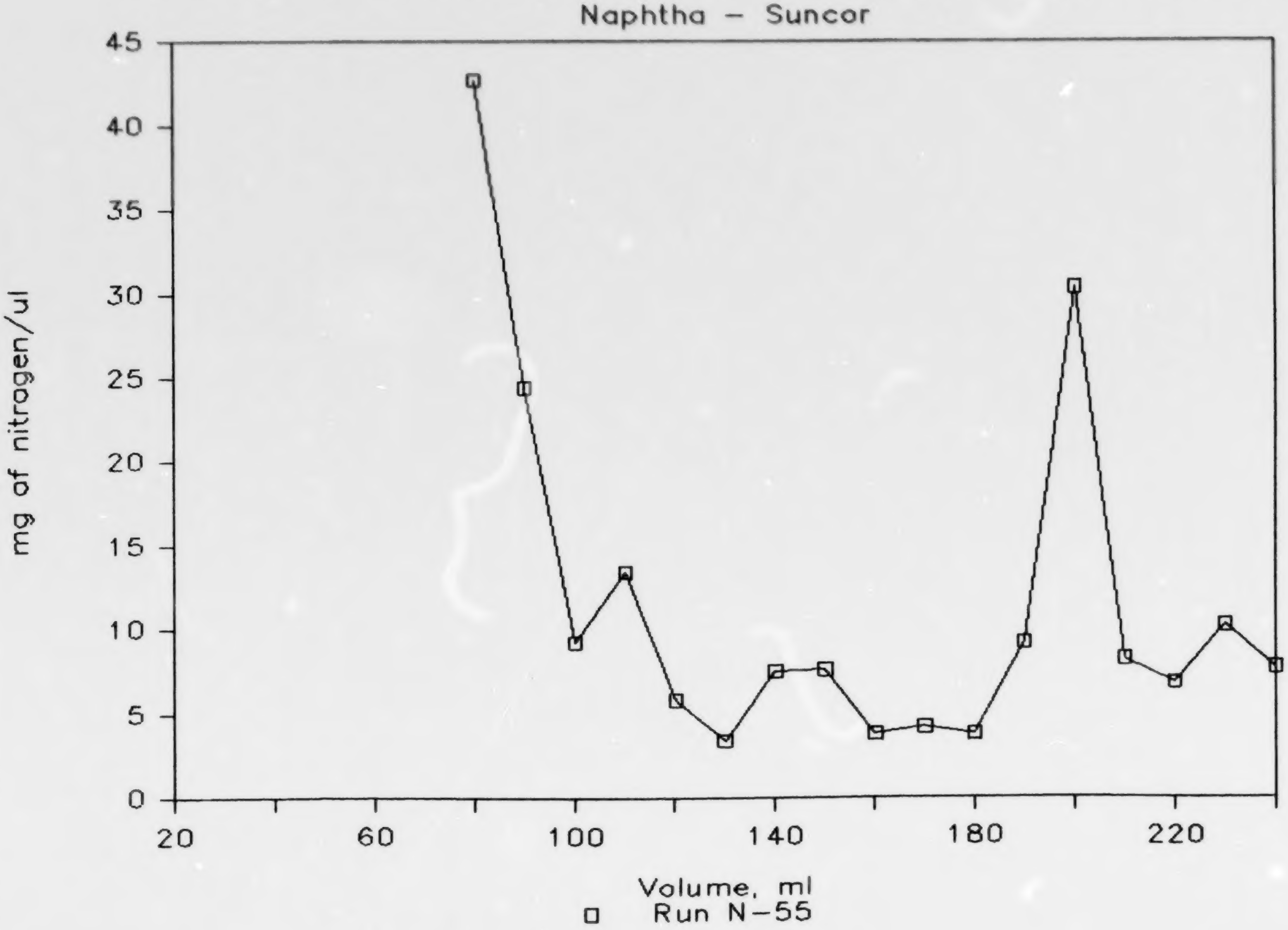


TOTAL NITROGEN BREAKTHROUGH CURVES

Naphtha - Gulf



TOTAL NITROGEN BREAKTHROUGH CURVES



Volume

2

the cambrian engineering group limited

COPY NO.__________

APPENDIX (VOLUME 2)
FOR FINAL REPORT
ON
A STUDY INTO THE
SEPARATION OF NITROGENOUS
MATERIAL FROM NAPHTHA FRACTIONS

NOVEMBER, 1986

DSS File Number 03SQ-23440-4-9176
Contract Serial Number OSQ85-~~0004~~ 00004
Cambrian Project Number C7025
November, 1986

206 pp

MICROMEDIA

7.0 Appendix

Run N-57: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.14579	0	0.003643	0.055866	0.005621	0.007239	0.009199	0.0102	0.019621	0.022771	0.004193
6	60	0.112448	0	0.010958	0.074624	0.010615	0.017379	0.014801	0.020018	0.027277	0.027488	0.00324
7	70	0.098132	0	0.007701	0.083635	0.012838	0.019286	0.014637	0.022462	0.03351	0.021073	0.019558
8	80	0.091967	0	0.005482	0.112574	0.014787	0.023458	0.020643	0.025083	0.062584	0.017414	0
9	90	0.088002	0	0.003657	0.13376	0.012859	0.018428	0.031184	0.021831	0.139515	0.05299	0
10	100	0.053802	0	0.003524	0.084005	0.00627	0.012287	0.021595	0.009484	0.13278	0.038911	0
11	110	0.042348	0	0.001947	0.038713	0.003239	0.00509	0.008838	0.004582	0.059234	0.016585	0
12	120	0.043793	0	0.0028	0.044797	0.004365	0.004738	0.010558	0.006347	0.069228	0.020406	0
13	130	0.009855	0	0.002756	0.040009	0.004579	0.004296	0.009246	0.006927	0.05633	0.017725	0
14	140	0.015677	0	0.003222	0.059261	0.00747	0.007565	0.017264	0.013627	0.107183	0.044069	0.004106
15	150	0.052129	0	0.003006	0.056808	0.007941	0.008429	0.019618	0.014422	0.119712	0.064293	0.007048
16	160	0.052855	0	0.006063	0.052135	0.010094	0.009261	0.01762	0.015358	0.094027	0.06848	0.005334
17	170	0.044288	0	0.006983	0.051132	0.011149	0.009484	0.016956	0.016909	0.0849	0.068347	0.004568
18	180	0.025589	0	0.00958	0.056308	0.013682	0.023728	0.019684	0.023355	0.079567	0.075776	0.006695
19	190	0.249929	0	0.010065	0.054344	0.017098	0.028723	0.025809	0.031438	0.094434	0.104586	0.01335
20	200	1.36752	0	0.005516	0.029095	0.007395	0.011573	0.025576	0.022072	0.061793	0.056605	0.046908
21	210	2.326802	0	0.006051	0.024883	0.009211	0.008687	0.052061	0.014737	0.017345	0.019305	0.040939
22	220	1.774546	0	0.006415	0.03674	0.019525	0.054264	0.460627	0.023907	0.022974	0.04516	0.070484
23	230	1.463678	0	0.010055	0.030285	0.014915	0.132064			0.019219	0.014394	0.074275
24	240	1.407623	0	0.013167	0.032239	0.016712	0.272734			0.021075	0.02006	0.099015

Run R-57: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.183326	0.2591	0.039384	1.193996	0.398518	0.926804	1.024787		0.008087	0.020845	0.080222
2	100	0.038178	0.036591	0.007841	0.215817	0.151614	0.132655	0.135584	0.069354	0	0.013343	0.033083
3	150	0.051011	0.054468	0.008286	0.120578	0.116758	0.070008	0.063657	0.047475	0	0.010817	0.010248
4	200	0.010022	0.044218	0.006125	0.088699	0.091347	0.078782	0.05987	0.021968	0	0	0.007163
5	250	0	0.035039	0.004701	0.078215	0.08792	0.0816	0.055601	0.014321	0	0	0.00404
6	300	0	0.029533	0.003237	0.059581	0.065464	0.061541	0.041837	0.008934	0	0.010778	0
7	350	0	0.018738	0.002681	0.054191	0.061482	0.060539	0.037865	0.007829	0	0.007367	0
8	400	0	0.0176	0.002148	0.045742	0.051859	0.052209	0.031181	0.006739	0	0.011116	0
9	450	0	0	0	0.046055	0.054452	0.056305	0.031443	0.006838	0	0.007706	0
10	500	0	0	0	0.036294	0.03967	0.041991	0.023295	0.004199	0	0	0
11	550	0	0	0	0.036303	0.040971	0.043105	0.023206	0.004408	0	0	0
12	600	0	0	0	0.030884	0.035592	0.03655	0.01826	0.003765	0	0	0
13	650	0	0	0	0.026911	0.031337	0.031441	0.015105	0.003471	0	0	0
14	700	0	0	0	0.026277	0.03138	0.031288	0.01445	0.00327	0	0	0
15	750	0	0	0	0.023567	0.030587	0.02852	0.01249	0.00315	0	0	0
16	800	0	0	0	0.021534	0.027049	0.025244	0.011409	0	0	0	0
17	850	0	0	0	0.018016	0.022467	0.020065	0.008997	0	0	0	0
18	900	0	0	0	0.020307	0.027271	0.023071	0.010391	0	0	0	0

Run N-58: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.017119	0	0.00236	0	0.080233	0.010937	0.00548	0	0	0.006427	0.005838
6	60	0.03699	0	0.004934	0	0.101521	0.011672	0.00407	0	0	0.009879	0.004517
7	70	0	0	0.005565	0	0.084589	0.016165	0.011474	0	0	0.019476	0.017043
8	80	0.005394	0	0.002975	0	0.072914	0.009871	0.009279	0.004585	0	0.015586	0.020276
9	90	0.020005	0	0	0	0.066089	0.017326	0.014666	0.10497	0	0.020421	0.022442
10	100	0.011887	0	0	0	0.05659	0.010283	0.016142	0.009418	0	0.017551	0.027516
11	110	0.012601	0	0	0	0.046028	0.008457	0.015609	0.009827	0	0.015522	0.030814
12	120	0.024693	0	0	0	0.042502	0.009265	0.015984	0.015823	0	0.019325	0.033932
13	130	0.152923	0	0	0.007661	0.022278	0	0.018823	0.014263	0	0.011852	0.022934
14	140	0.734921	0	0.0091	0.010338	0.01539	0.012277	0.018588	0.01478	0	0.010452	0.006539
15	150	1.56543	0	0.00429	0.008422	0.012252	0.032951	0.055672	0.021834	0	0	0.014847
16	160	1.44305	0	0.004573	0.010268	0.010722	0.094241			0	0	0.037603
17	170	1.220818	0	0.005699	0.011936	0.007727	0.160695			0	0	0.05073
18	180	1.427738	0	0.008971	0.058165	0	0.377124			0	0	0.08487
19	190	1.24176	0	0.010949	0.310989	0.02736	0.613602			0	0	0.095632
20	200	0.677695	0	0.00691	0.820172	0	0.670057			0	0.026225	0.085739
21	210	1.006083	0	0.004983	1.156953	0.131982	0.68601			0	0.010537	0.097231
22	220	1.18906	0.062862	0.011916	1.495018	0.269427	0.723169			0	0.029637	0.112079
23	230	1.143429	0.172708	0.017901	1.705951	0.460426	0.839723			0	0.02485	0.128003
24	240	0.886717	0.787532	0.023362	1.718378	0.701908	0.833087			0	0.031693	0.104968

Run R-66: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.410604	0.621262	0.259223	1.100306	1.174167	1.269033	0.969275	0.496009	1.154224	0.431174	0.345627
2	100	0.065513	0.167011	0.056671	0.478831	0.60991	0.559568	0.364046	0.172245	0.226636	0.040134	0.083698
3	150	0	0.056165	0.014683	0.240258	0.293489	0.208037	0.165	0.035794	0.227246	0.040242	0.083924
4	200	0	0.015776	0.00577	0.170247	0.244223	0.14161	0.128298	0	0.118733	0.024713	0.031918
5	250	0	0	0	0.126023	0.187501	0.09198	0.084573	0	0.05444	0	0.023216
6	300	0	0	0	0.091993	0.142902	0.063204	0.058266	0	0.027778	0	0
7	350	0	0	0	0.070645	0.1178	0.049831	0.044589	0	0.019502	0	0
8	400	0	0	0	0.055345	0.092514	0.032047	0.030743	0	0	0	0
9	450	0	0	0	0.042692	0.077811	0.026431	0.023959	0	0	0	0
10	500	0	0	0	0.030783	0.06572	0.027068	0.019078	0	0	0	0
11	550	0	0	0	0.025338	0.0581	0.024203	0.016487	0	0	0	0
12	600	0	0	0	0.018469	0.047248	0.019993	0.012895	0	0	0	0
13	650	0	0	0	0.016533	0.044585	0.018999	0.012083	0	0	0	0
14	700	0	0	0	0.013966	0.040865	0.017793	0.011052	0	0	0	0
15	750	0	0	0	0.011003	0.03585	0.01583	0.009691	0	0	0	0
16	800	0	0	0	0.008912	0.031494	0.014218	0.008577	0	0	0	0
17	850	0	0	0	0.007124	0.027802	0.012863	0.00636	0	0	0	0
18	900	0	0	0	0.006006	0.024705	0.011814	0.005795	0	0	0	0

Run N-66: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0		0	0
2	20	0	0	0	0	0	0	0	0		0	0
3	30	0	0	0.003599	0.010036	0.030678	0.019451	0.015127	0.015779		0	0
4	40	0	0	0	0	0.06072	0.010538	0.004004	0.004607		0.003009	0
5	50	0.01312	0	0.002944	0	0.0746	0.009707	0.004097	0.002853			0
6	60	0.012254	0	0.007342	0	0.106527	0.014273	0.008575	0.006295			0
7	70	0	0	0.003037	0	0.060708	0.008366	0.004572	0.005874			0.00291
8	80	0	0	0.003128	0	0.060287	0.009145	0.001737	0.00647			0.009487
9	90	0	0	0	0	0.048264	0.008995	0	0.010917			0.015848
10	100	0	0	0	0	0.038634	0.00593	0.002487	0.009387			0.016072
11	110	0.00777	0	0	0	0.032014	0.004311	0	0.007402			0.021432
12	120	0.014919	0	0	0	0.035893	0.003988	0	0.010031			0.011592
13	130	0	0	0	0	0.025312	0	0.003906	0.009052			0.02183
14	140	0.145422	0	0	0.00486	0.009213	0	0.007556	0.009497			0.049126
15	150	0.563545	0	0	0.00483	0.025788	0	0.006609	0.005876			0.048769
16	160	1.003975	0	0.006948	0.010092	0.018264	0.054491	0.438416	0.011438		0	0.054781
17	170	0.848844	0	0.006061	0.010397	0.006438	0.238588			0	0	0.052258
18	180	0.454726	0	0.007042	0.022076	0	0.551753			0	0	0.068515
19	190	0.601859	0	0.006457	0.599914	0	0.797245			0	0	0.091727
20	200	0.623261	0	0.006565	1.338448	0.16205	0.728284			0	0	0.071973
21	210	0.419743	0.098036	0.011605	1.481623	0.349326	0.71834			0	0	0.070581
22	220	0.481559	0.321171	0.020141	1.401364	0.567064	0.706349			0	0	0.0658
23	230	0.573471	0.468938	0.031805	1.30372	0.717145	0.712836			0	0	0.065593
24	240											
25	DEP	0.282585	0.245369	0.193591	0.64284	0.53956	0.519382	0.629622	0.306387	0.139627	0.140583	0.202813

Run R-58: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

						C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.275242	0.200397	0.063348	1.129026	1.045927	1.243935	0.928309	0.322451	1.133442	0.313602	0.562322
2	100	0.053702	0.038807	0.015863	0.248649	0.321351	0.288795	0.163784	0.083883	0.357236	0.06638	0.111888
3	150	0.011911	0	0.008544	0.162897	0.209056	0.161685	0.111371	0.02979	0.161343	0.025581	0.066042
4	200	0.007917	0	0.004247	0.124662	0.15034	0.110341	0.079704	0	0.100955	0.01311	0.027156
5	250	0	0	0	0.111369	0.157339	0.107989	0.077117	0	0.098423	0	0.024816
6	300	0	0	0	0.083043	0.117389	0.066348	0.050658	0	0.054482	0	0.016604
7	350	0	0	0	0.06777	0.103475	0.059434	0.042563	0	0.042126	0	0.007271
8	400	0	0	0	0.05372	0.081697	0.038313	0.030518	0	0.025197	0	0
9	450	0	0	0	0.046263	0.075721	0.03546	0.026813	0	0.018142	0	0
10	500	0	0	0	0.038577	0.062879	0.026283	0.020771	0	0.013897	0	0
11	550	0	0	0	0.032108	0.53577	0.021712	0.018315	0	0	0	0
12	600	2.915242	0.014677	0.038075	0.025948	0.348484	0.065344	0.019898	0.282666	0.050172	0.218638	0
13	650	0.171821	0	0	0.037295	0.089917	0.061195	0.018084	0.139311	0.073428	0.140552	0.05674
14	700	0.033646	0	0	0.029156	0.050773	0.028316	0.013416	0.02051	0.009592	0.010069	0.034621
15	750	0.0069	0	0.002766	0.025201	0.045125	0.026772	0.012816	0.010253	0	0	0.006856
16	800	0.006993	0	0	0.019165	0.036803	0.017718	0.010544	0.004927	0	0	0.016258
17	850	0	0	0	0.014811	0.028961	0.017679	0.010458	0	0	0	0
18	900	0	0	0	0.01513	0.030882	0.016853	0.010566	0	0	0	0

Run N-67: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

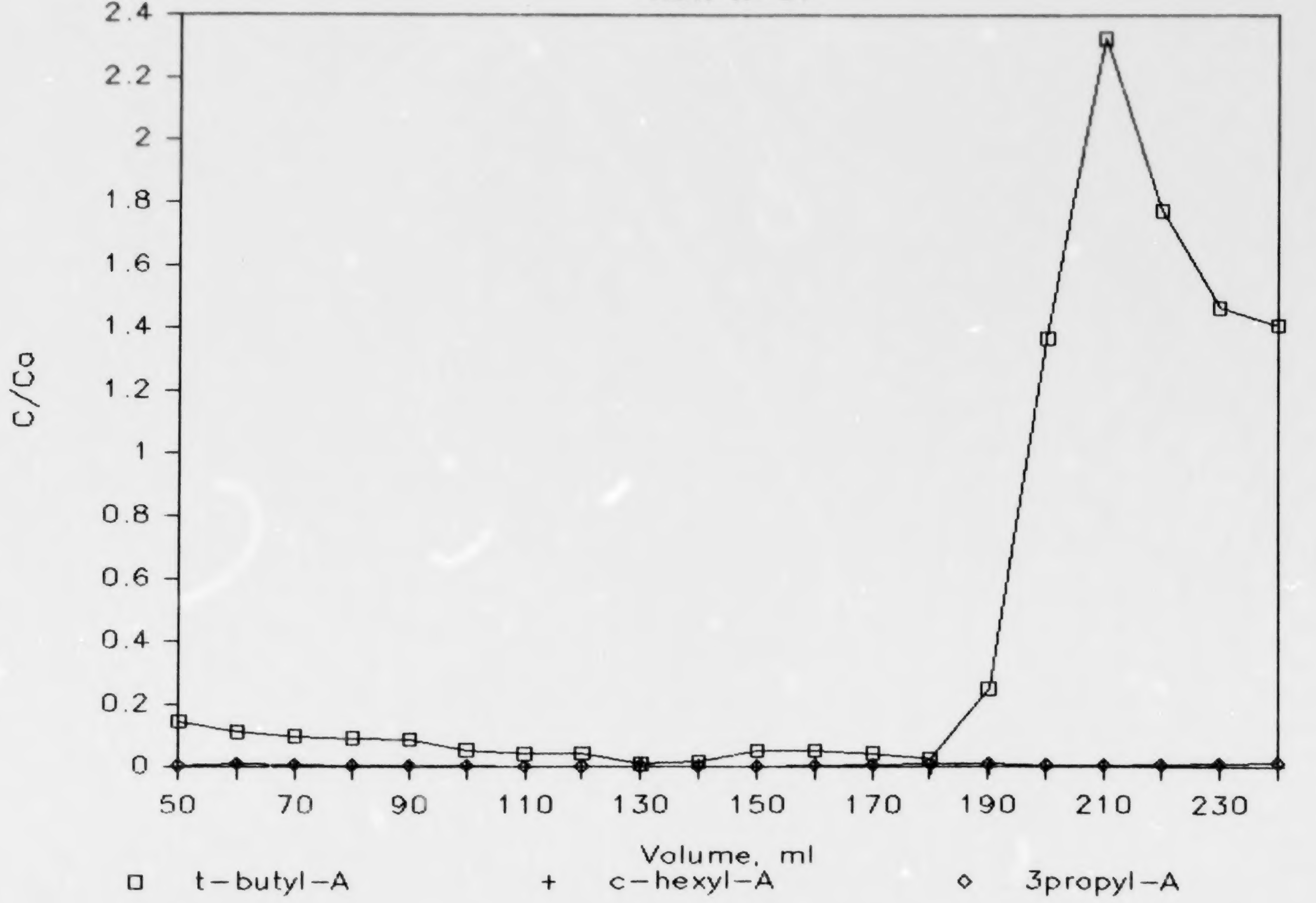
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0			0
2	20	0	0	0	0	0	0	0	0			0
3	30	0	0	0	0	0	0	0	0			0
4	40	0	0	0.004694	0.007238	0.019343	0.017187	0.014151	0.008005			0
5	50	0	0	0	0	0.016913	0	0	0			0
6	60	0	0	0	0	0.039352	0.0049	0	0			0
7	70	0	0	0.004238	0	0.051884	0.005312	0	0.004401			0
8	80	0	0	0.003558	0	0.041963	0.004382	0	0.005379			0
9	90	0	0	0.002633	0	0.028712	0.003511	0	0.00537			0
10	100	0	0	0.002662	0	0.033513	0.004141	0	0.007727			0
11	110	0	0	0.002618	0	0.037364	0.004351	0	0.009292			0.013137
12	120	0	0	0.002572	0	0.039967	0.004816	0	0.011698			0.011977
13	130	0	0	0	0	0.032208	0.004342	0	0.012569			0.01839
14	140	0.015645	0	0	0	0.013059	0	0	0.005942			0.016336
15	150	0.078859	0	0	0	0.010368	0	0.002548	0.008376			0.012812
16	160	0.699193	0	0	0.004298	0.008768	0	0.003834	0.007748			0.014319
17	170	0.706694	0	0	0.008065	0.010302	0.032782	0.17451	0.010254			0.016992
18	180	0.369034	0	0.004613	0.014606	0.010706	0.086898					0.039024
19	190	0.425252	0	0.01191	0.022551	0.008182	0.096056					0.043053
20	200	0.448798	0	0.016171	0.088323	0	0.244382					0.064113
21	210	0.302299	0	0.01756	0.525339	0	0.398344					0.094246
22	220	0.444048	0	0.01999	1.079134		0.520847					0.08526
23	230	0.3031	0	0.018906	1.61542	0.366381	0.635156					0.143959

Run R-67: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

		C/Co										
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.316759	0.583888	0.207642	1.104886	0.950333	1.190324	0.934619	0.483501	1.009342	0.418178	0.501022
2	100	0.029106	0.091418	0.042012	0.337219	0.382116	0.424365	0.277096	0.146004	0.404925	0.082233	0.087709
3	150	0.010091	0.018715	0.01064	0.19982	0.212915	0.19911	0.154788	0.035753	0.194611	0.013858	0.045061
4	200	0	0	0.004314	0.152678	0.192839	0.14075	0.129105	0	0.132[illegible]57	0	0.026738
5	250	0	0	0	0.113857	0.149206	0.09267	0.091267	0	0.079092	0	0.01745
6	300	0	0	0	0.082944	0.117986	0.063159	0.061333	0	0.037405	0	0.010037
7	350	0	0	0	0.065982	0.096907	0.046606	0.045248	0	0.026309	0	0
8	400	0	0	0	0.055823	0.085286	0.038569	0.036898	0	0.015332	0	0
9	450	0	0	0	0.045253	0.074297	0.032182	0.02926	0	0.010036	0	0
10	500	0	0	0	0.036999	0.064739	0.027274	0.023641	0	0	0	0
11	550	0	0	0	0.028245	0.05494	0.02437	0.019833	0	0	0	0
12	600	0	0	0	0.0239	0.046352	0.019278	0.01537	0	0	0	0
13	650	0	0	0	0.018417	0.039255	0.016505	0.012409	0	0	0	0
14	700	0	0	0	0.014946	0.034934	0.015112	0.01094	0	0	0	0
15	750	0	0	0	0.012103	0.031115	0.013935	0.009776	0	0	0	0
16	800	0	0	0	0.00976	0.027409	0.012492	0.008573	0	0	0	0
17	850	0	0	0	0.007708	0.024807	0.011714	0.007826	0	0	0	0
18	900	0	0	0	0.006517	0.022397	0.010789	0.007215	0	0	0	0

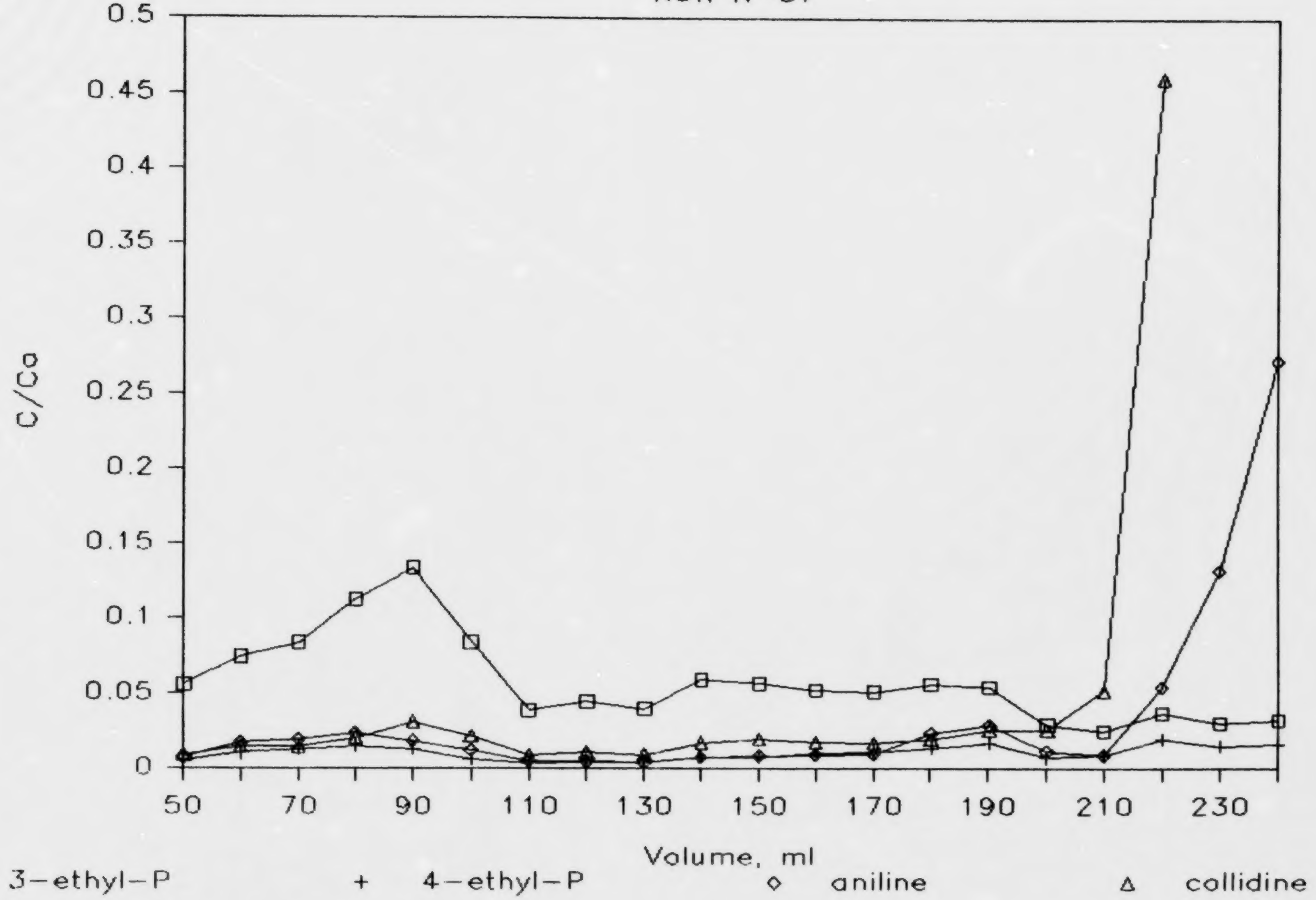
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-57



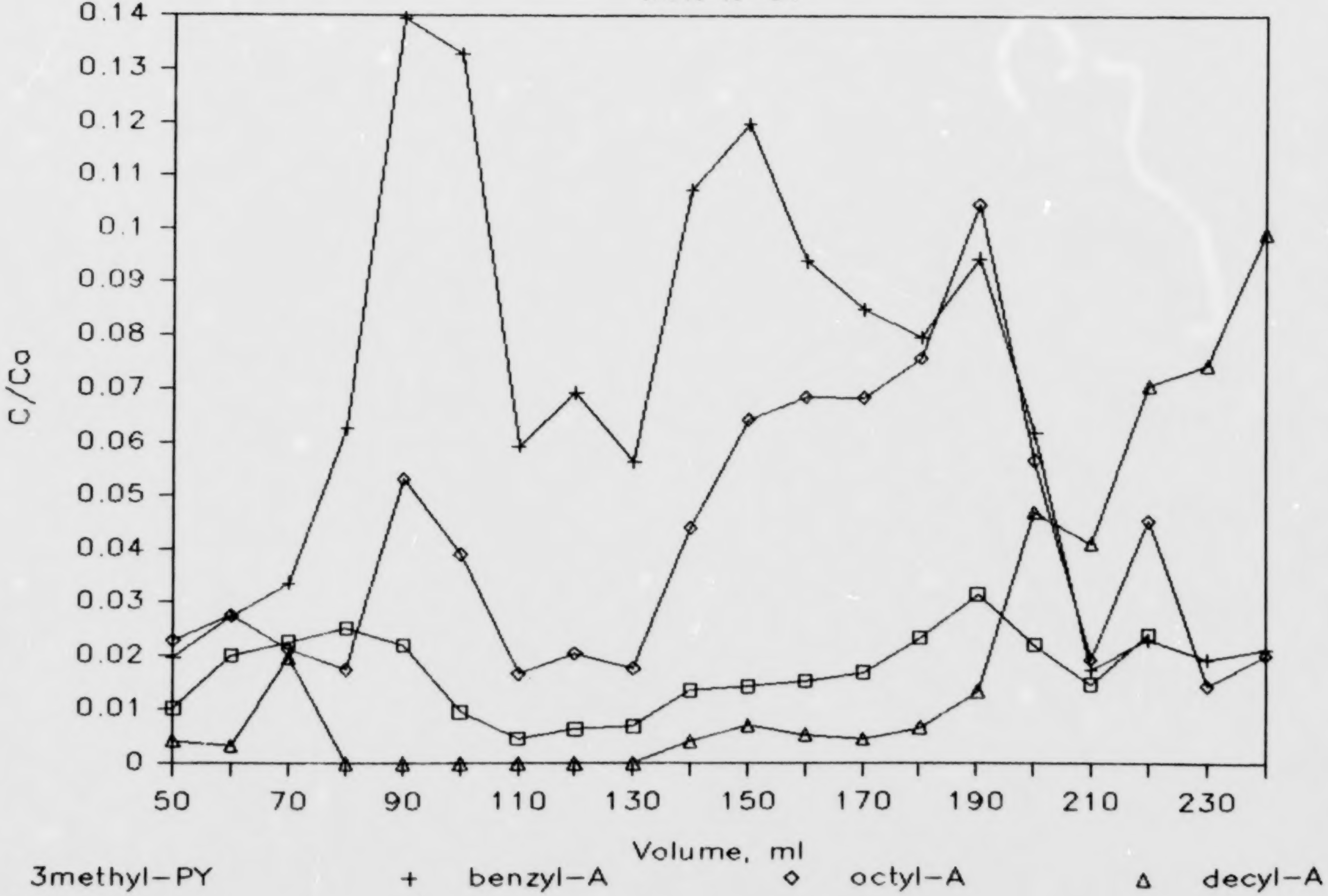
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-57

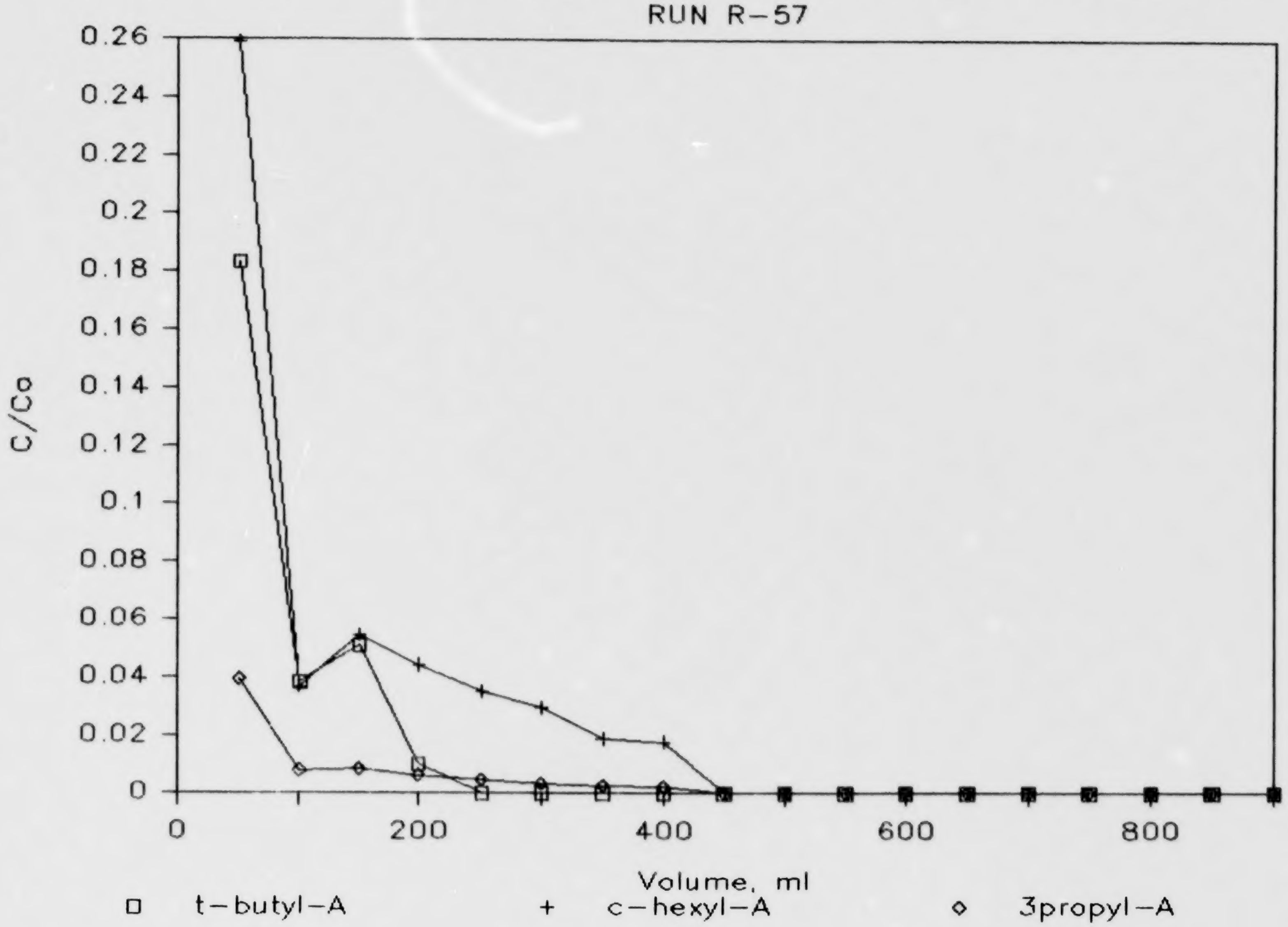


N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-57

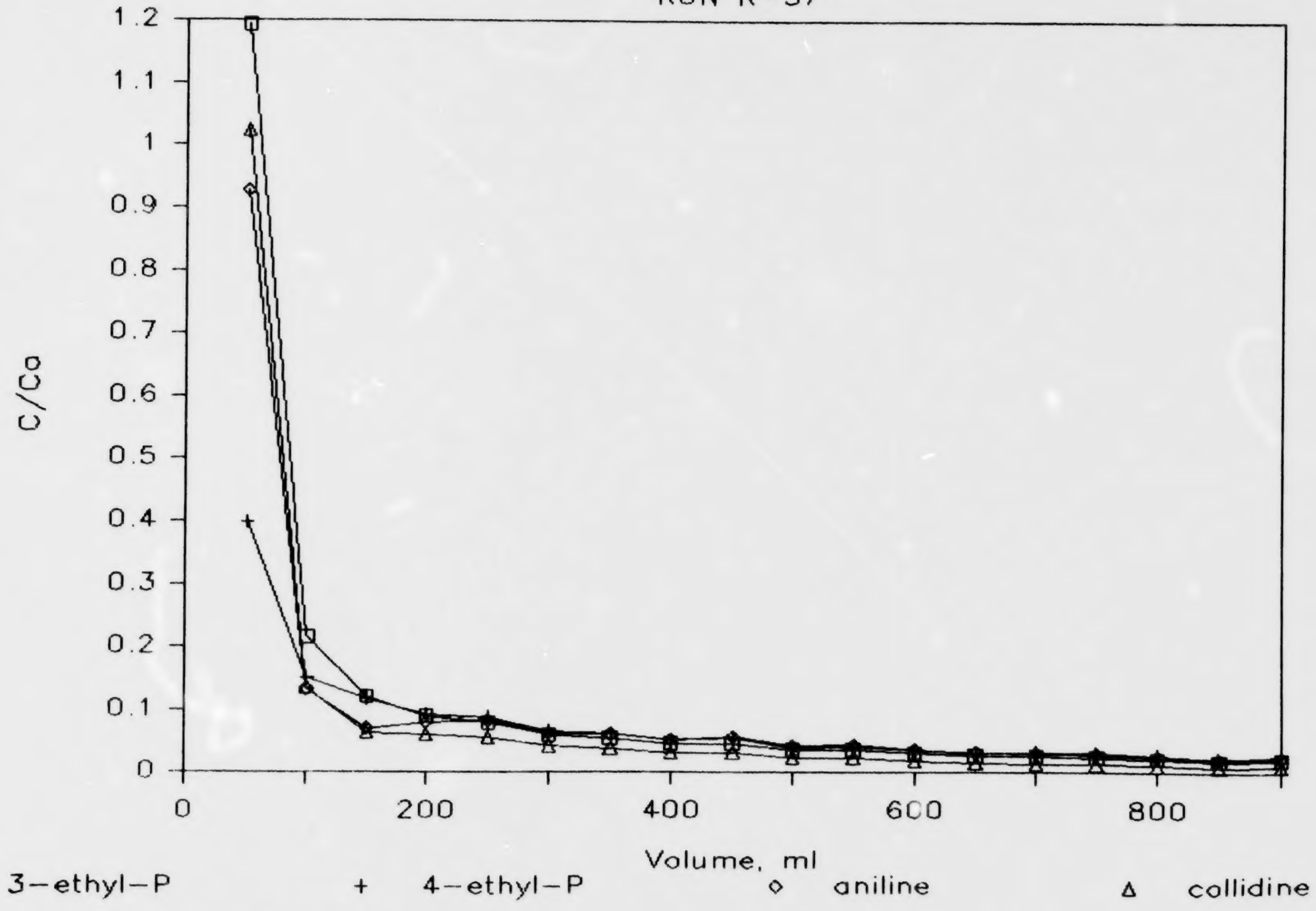


N-COMPOUNDS DESORPTION CURVES



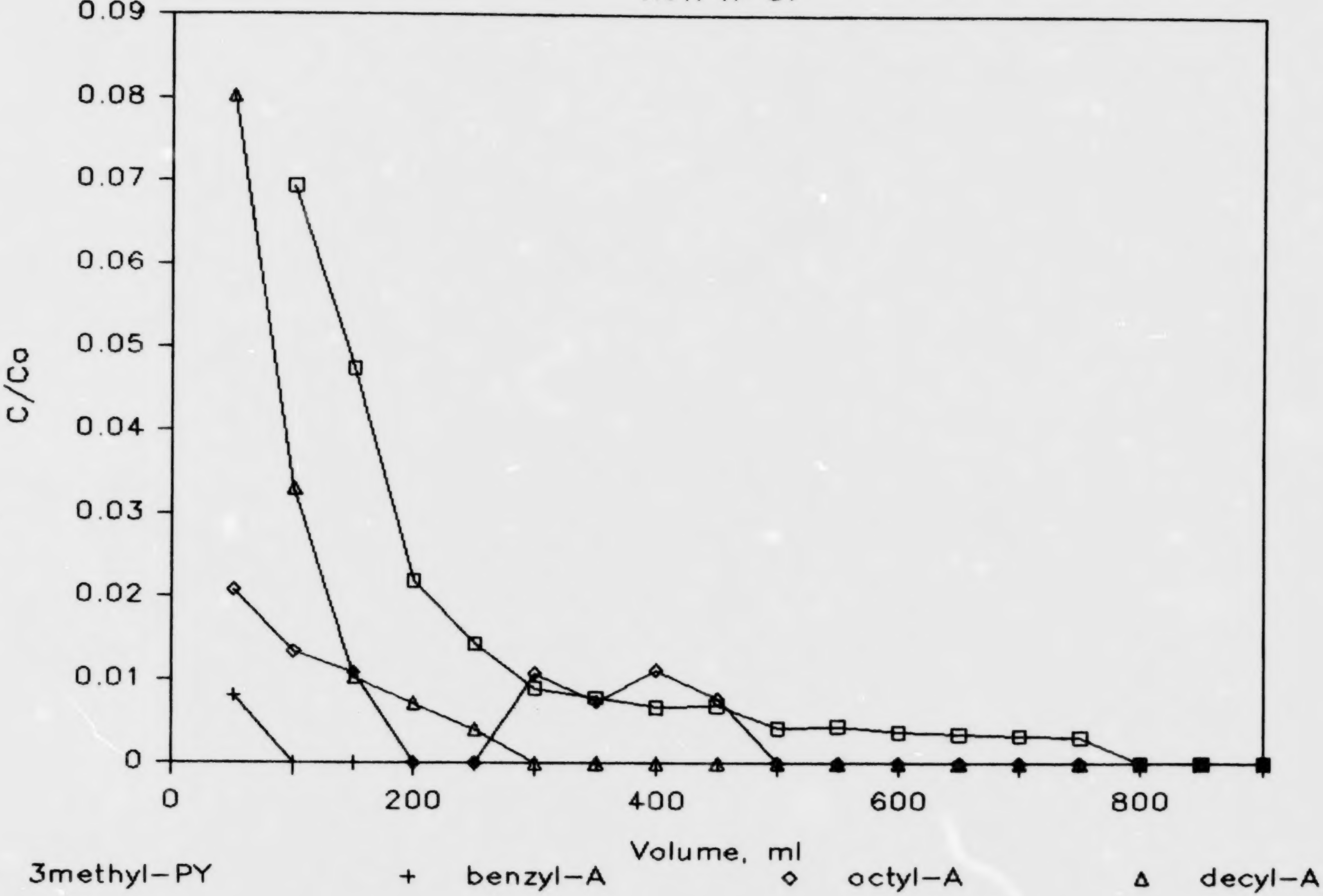
N–COMPOUNDS DESORPTION CURVES

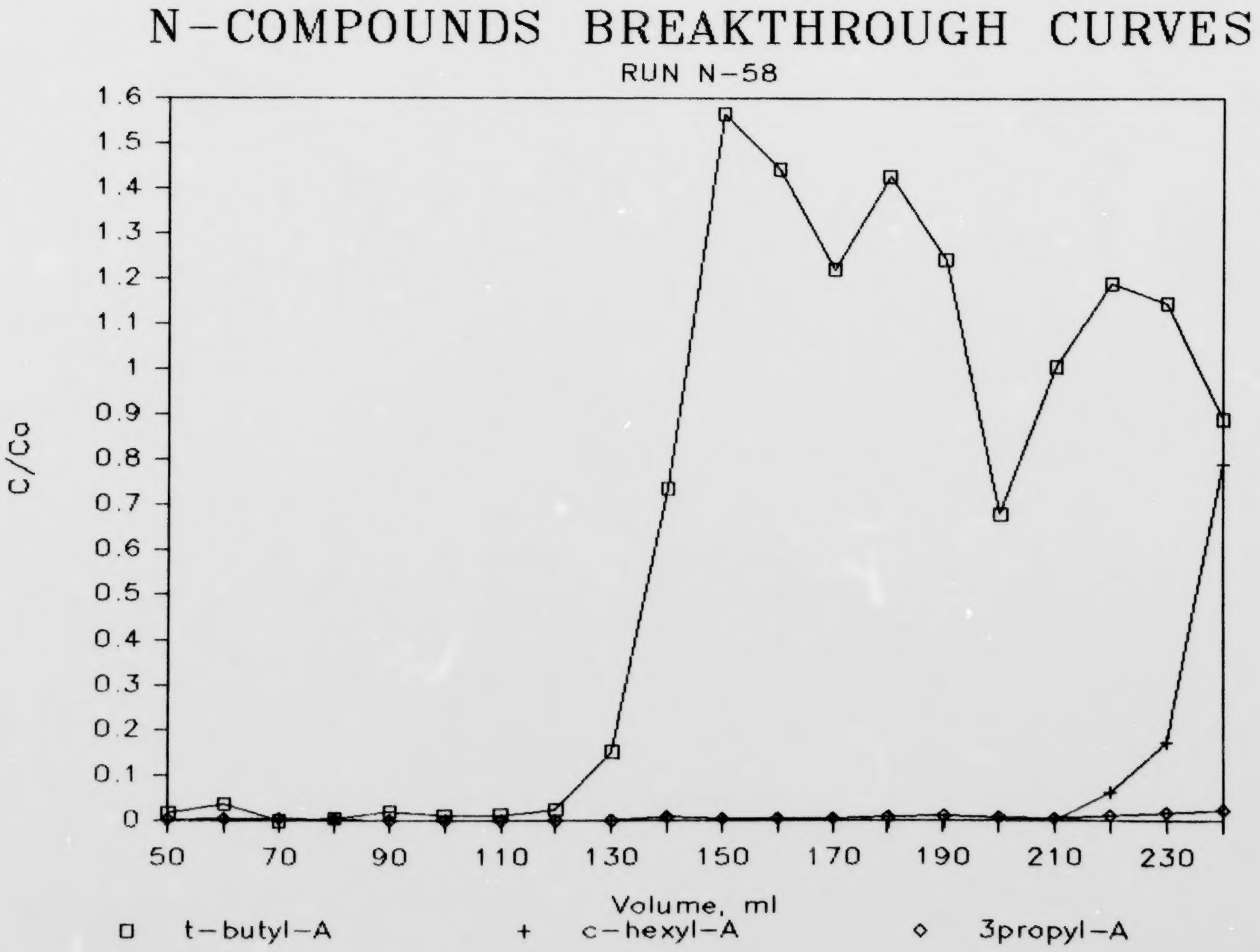
RUN R–57



N-COMPOUNDS DESORPTION CURVES

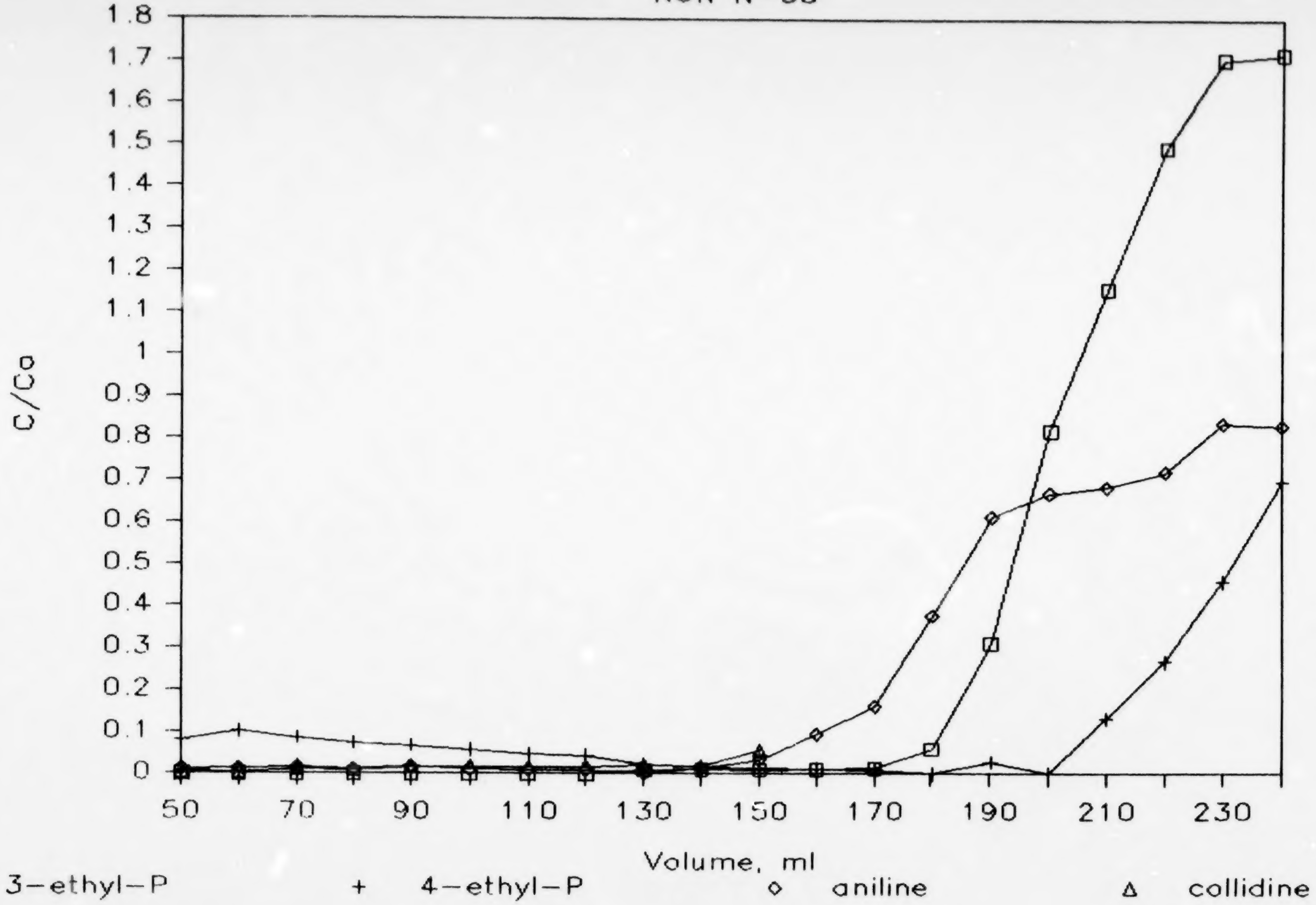
RUN R-57




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-58
C/Co
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
70
90
110
130
150
170
190
210
230
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

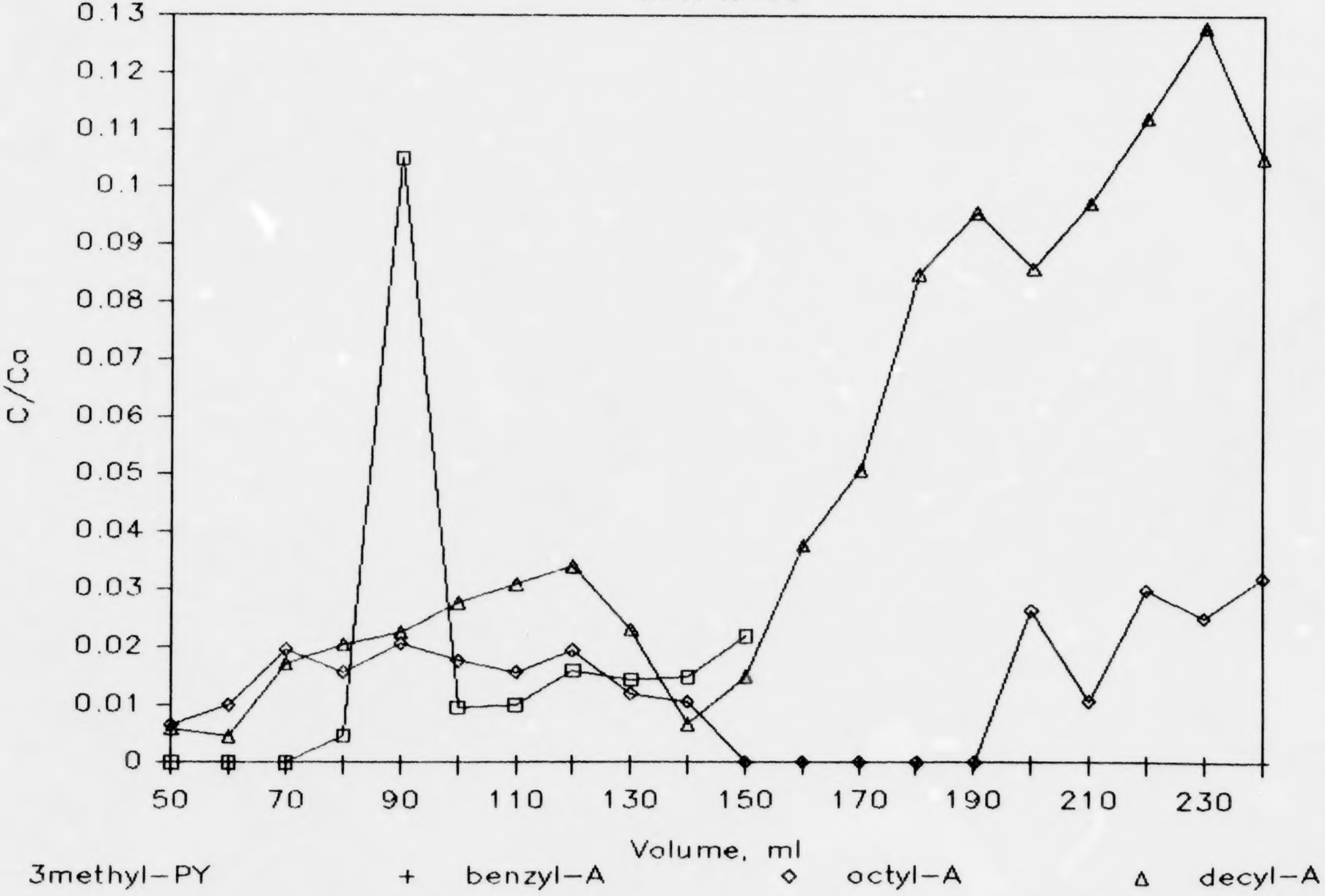
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-58



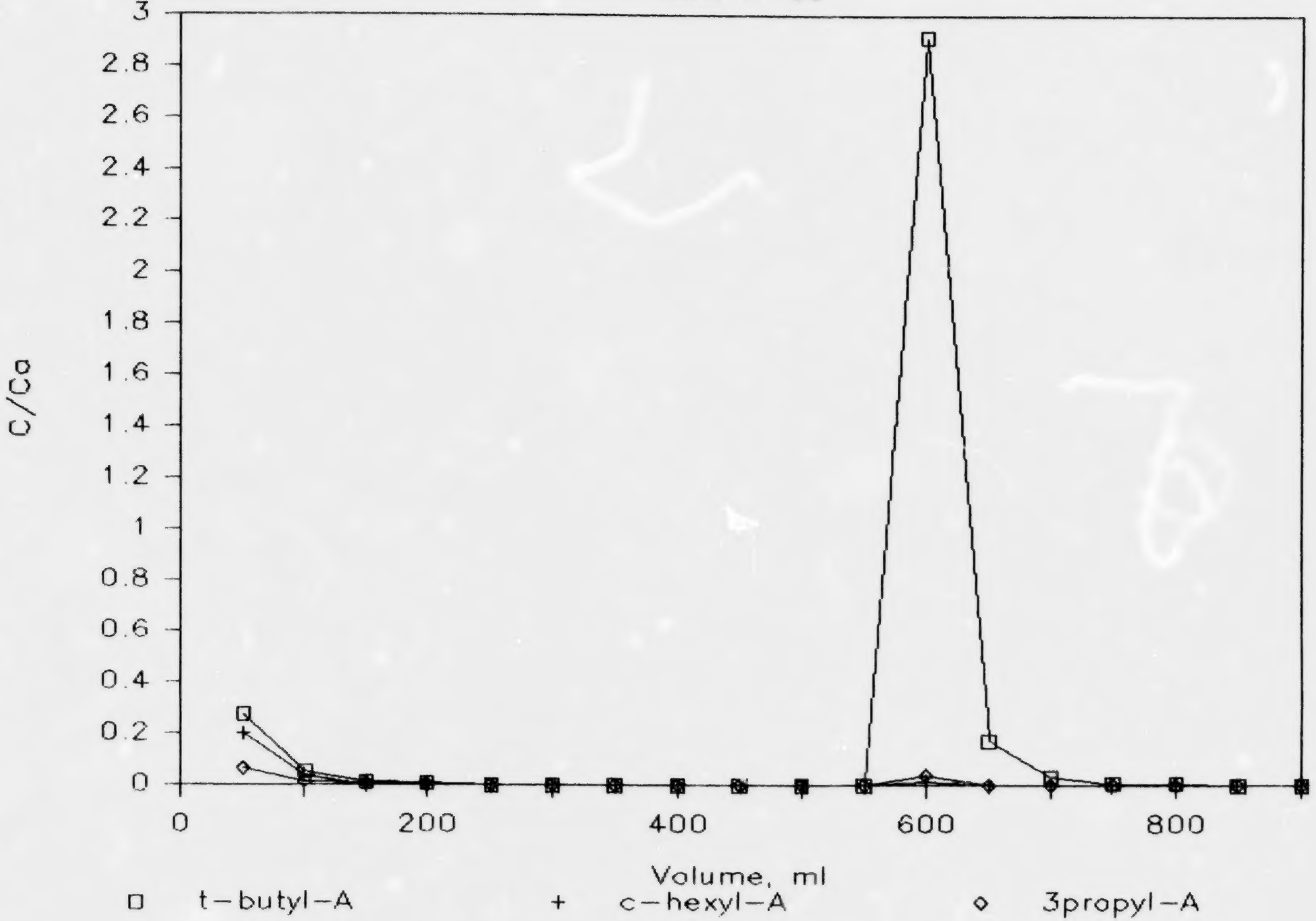
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–58



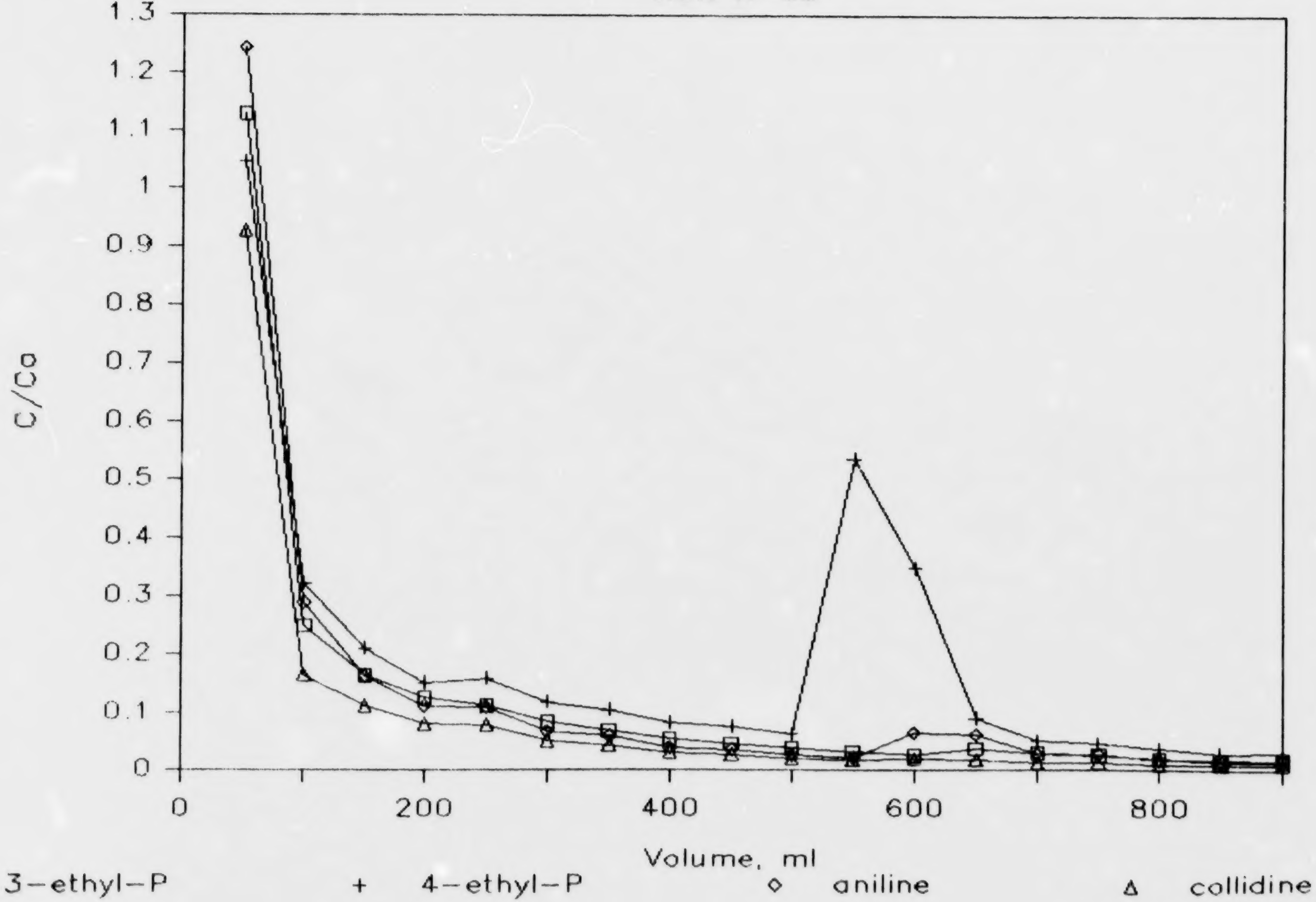
N-COMPOUNDS DESORPTION CURVES

RUN R-58



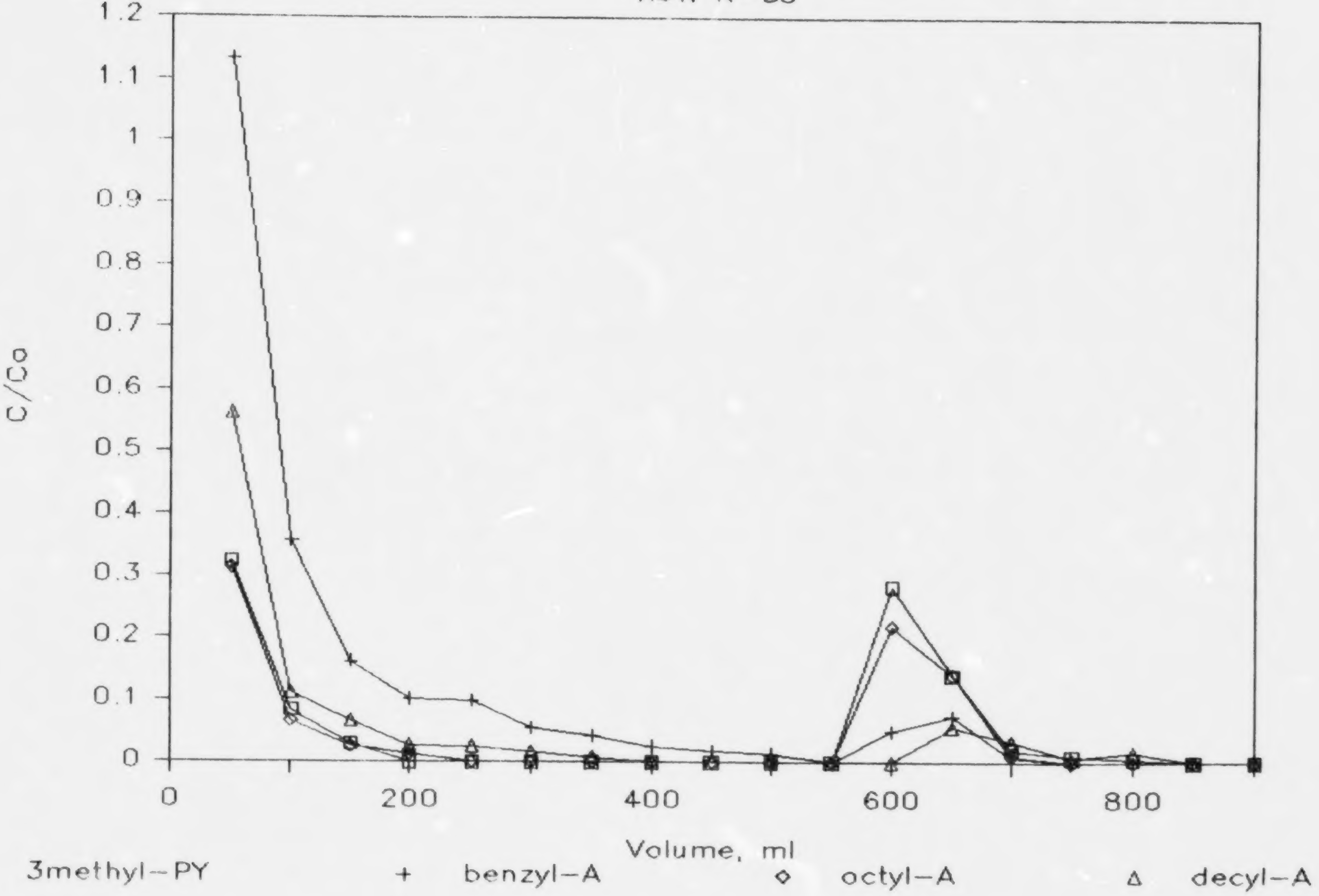
N-COMPOUNDS DESORPTION CURVES

RUN R-58



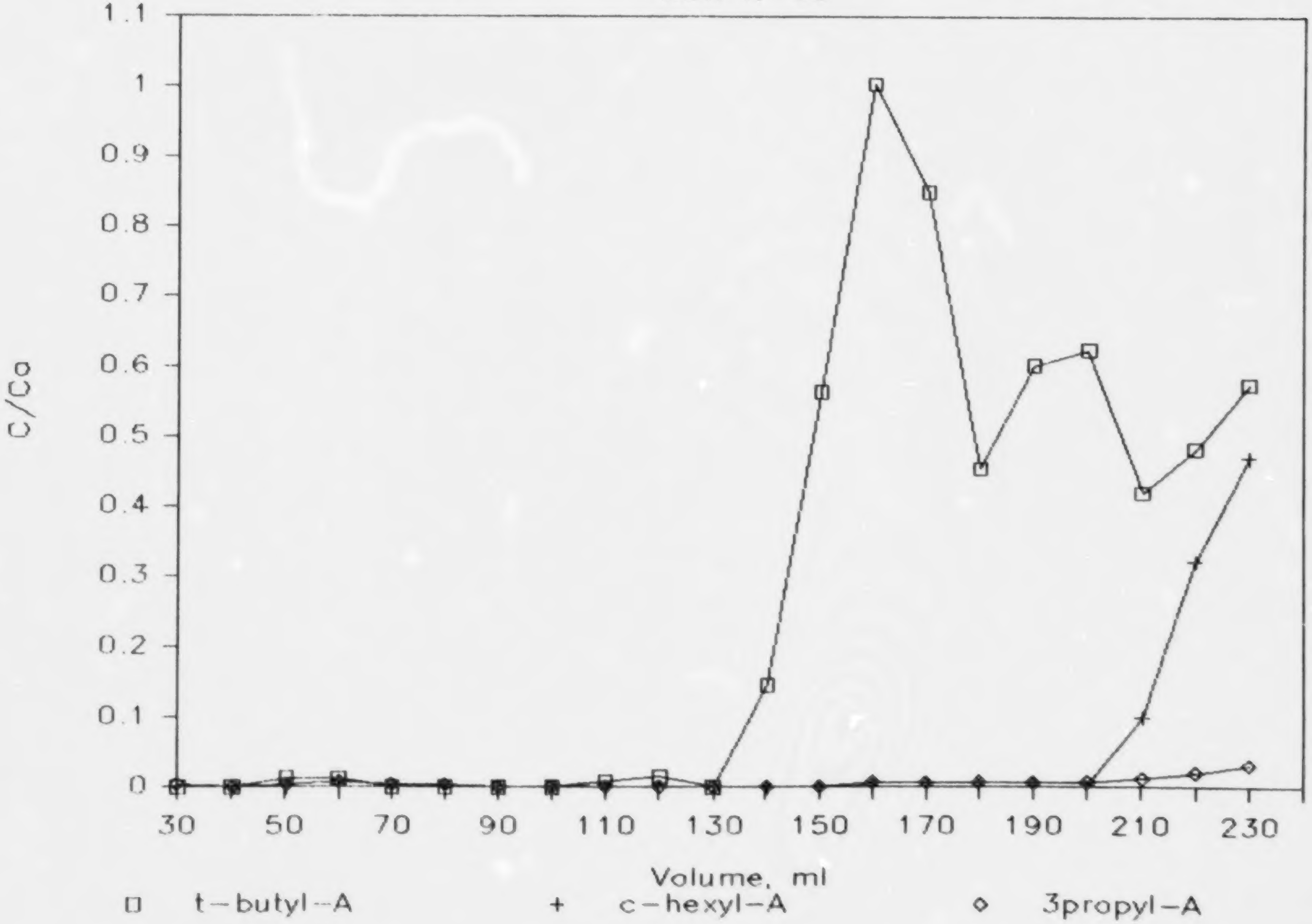
N-COMPOUNDS DESORPTION CURVES

RUN R-58



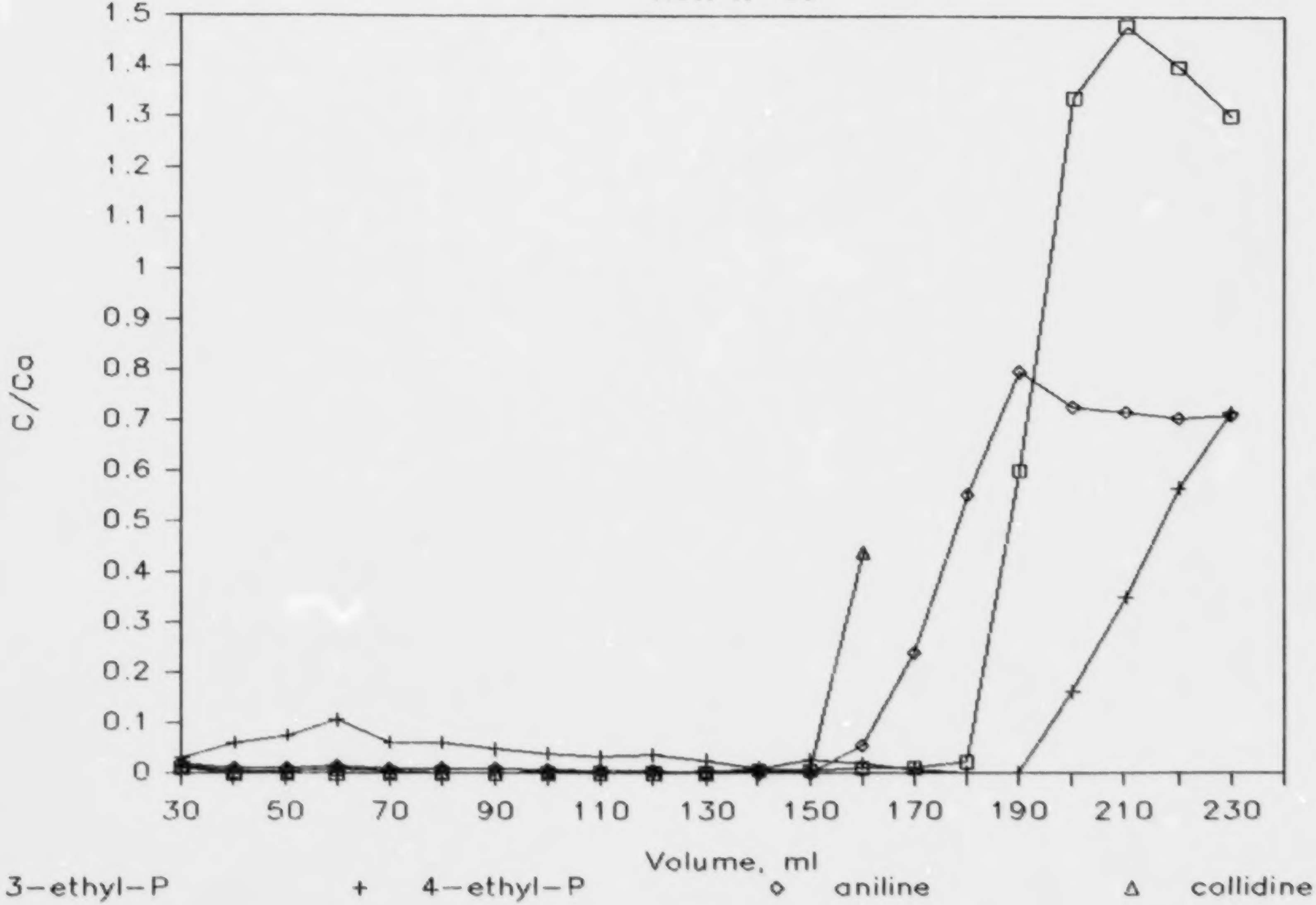
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-66



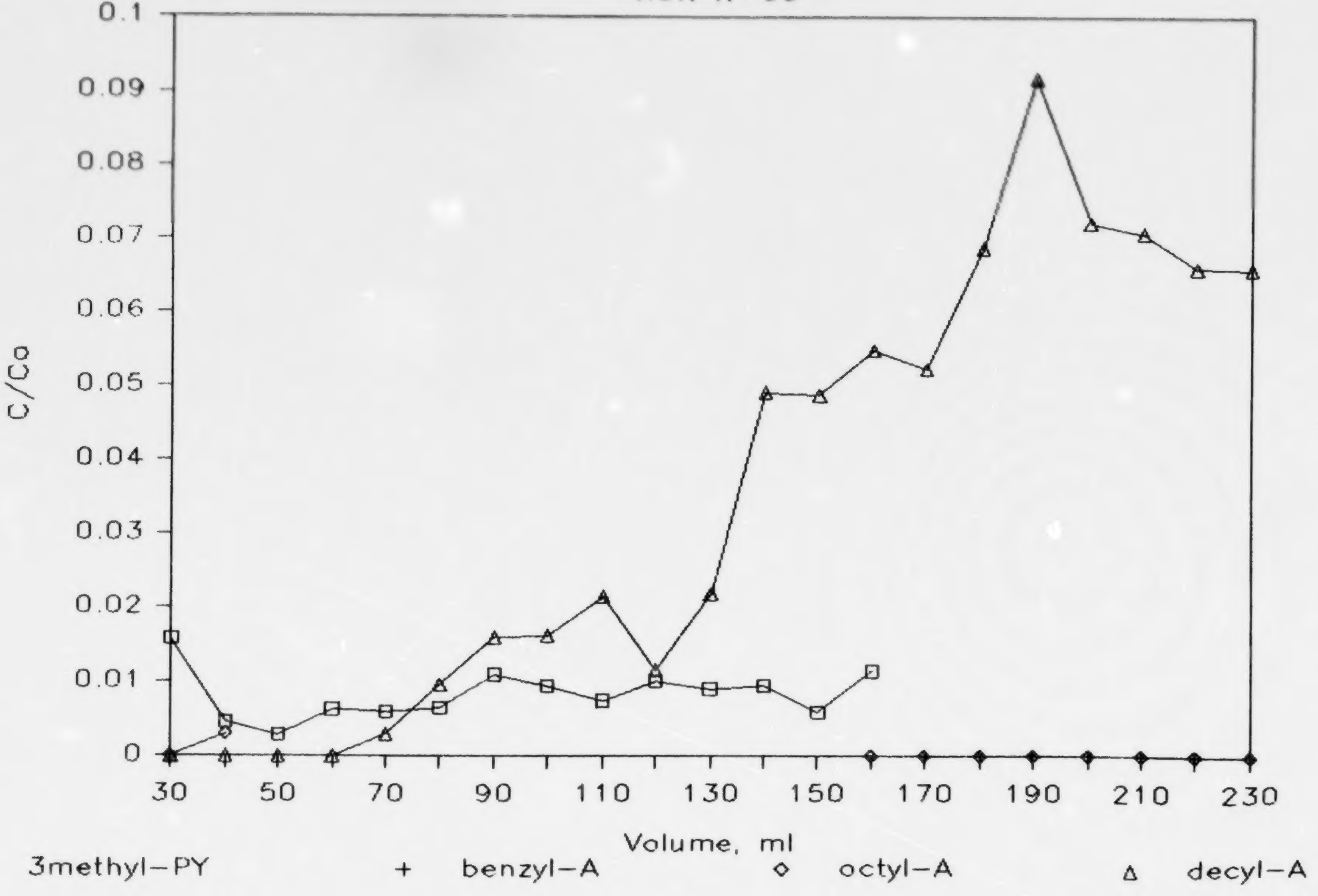
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-66



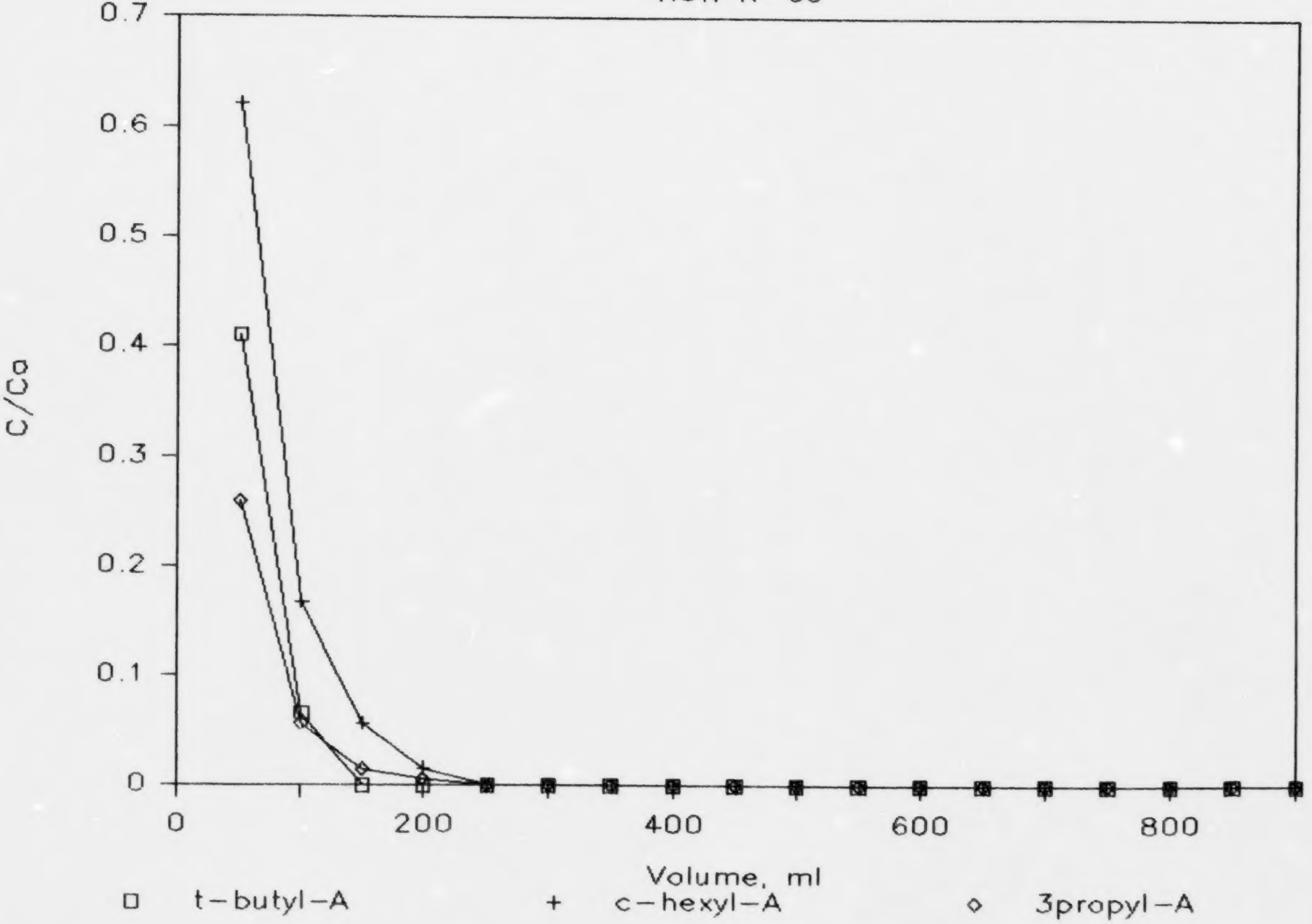
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–66



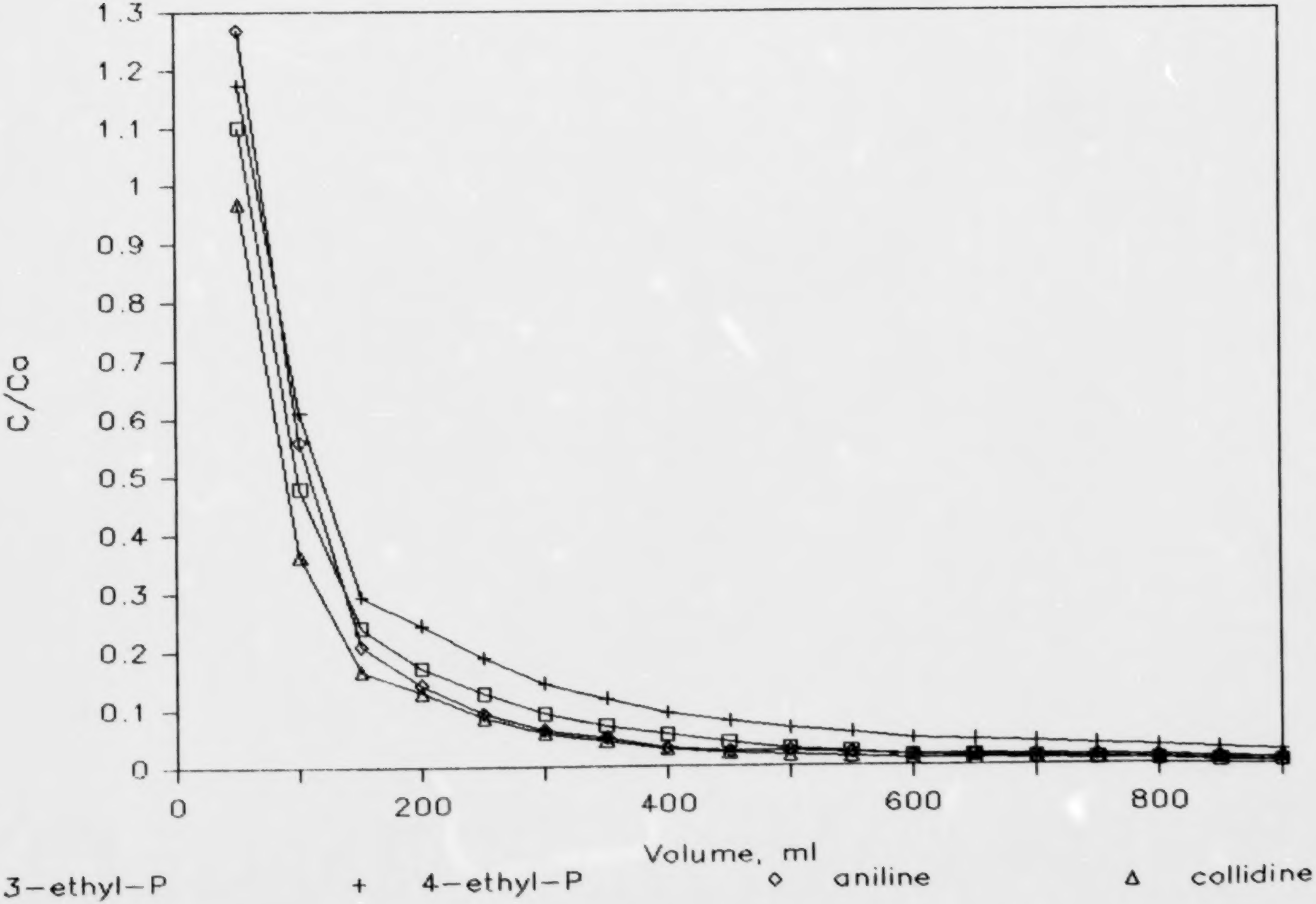
N-COMPOUNDS DESORPTION CURVES

RUN R-66



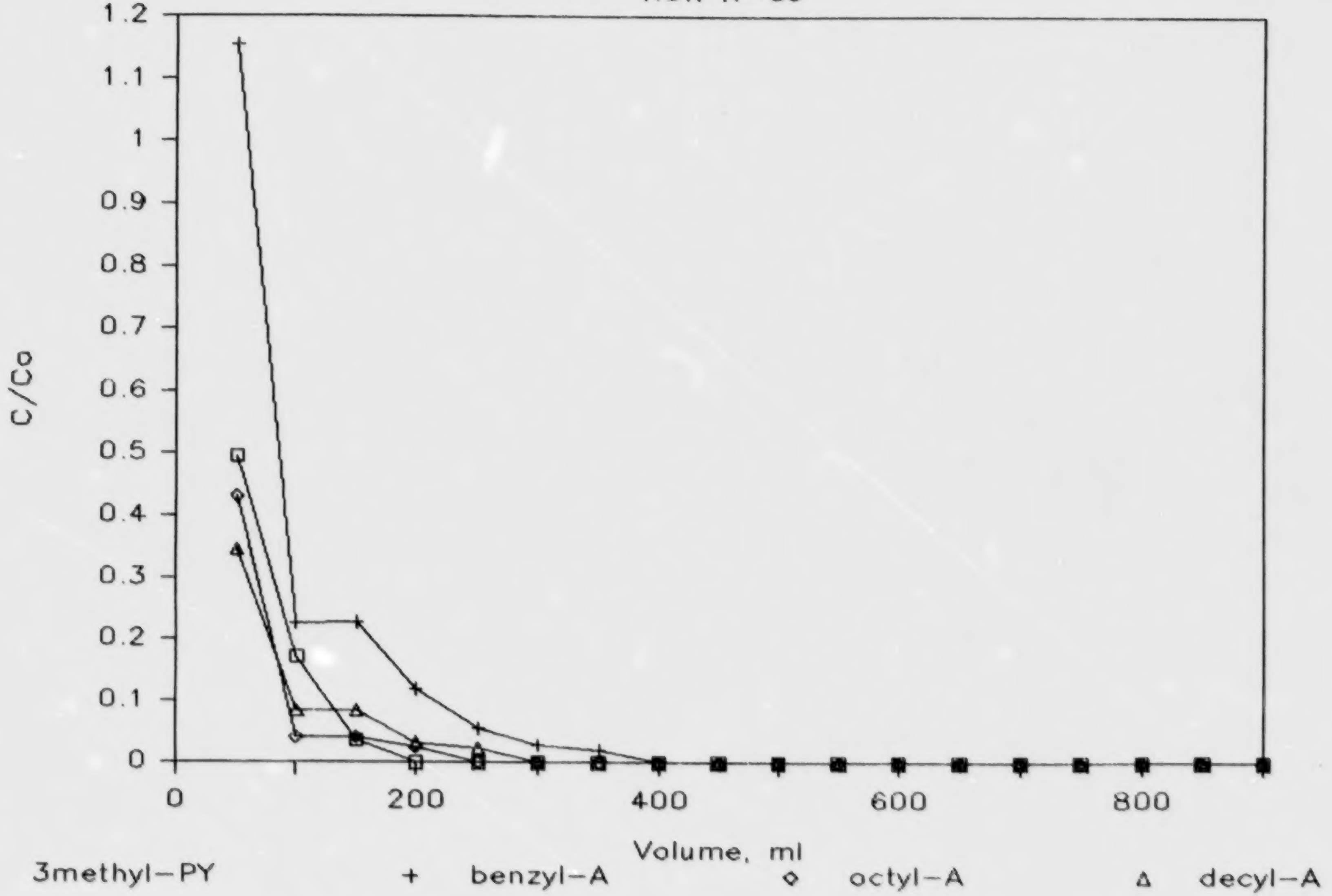
N-COMPOUNDS DESORPTION CURVES

RUN R-66



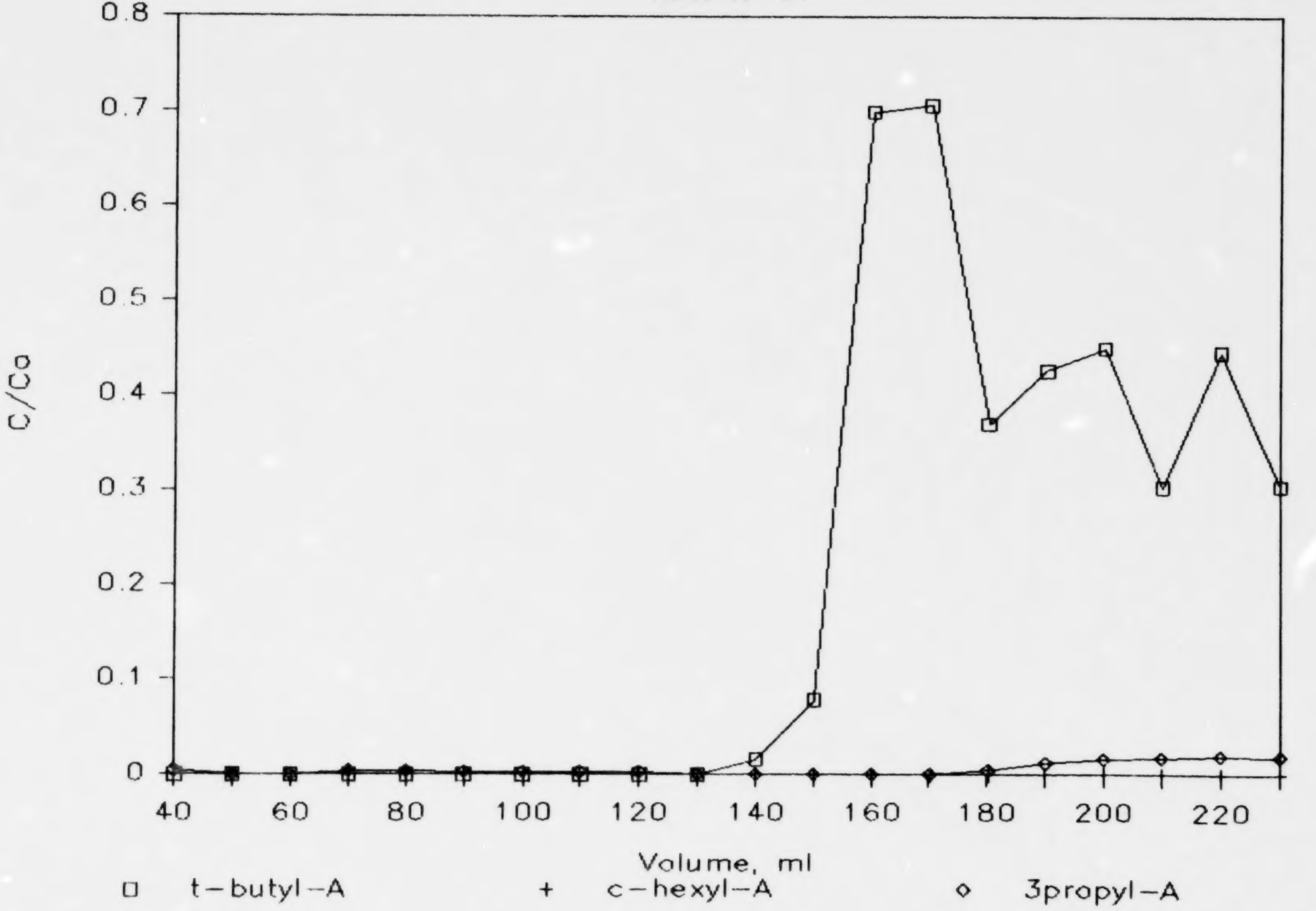
N-COMPOUNDS DESORPTION CURVES

RUN R-66



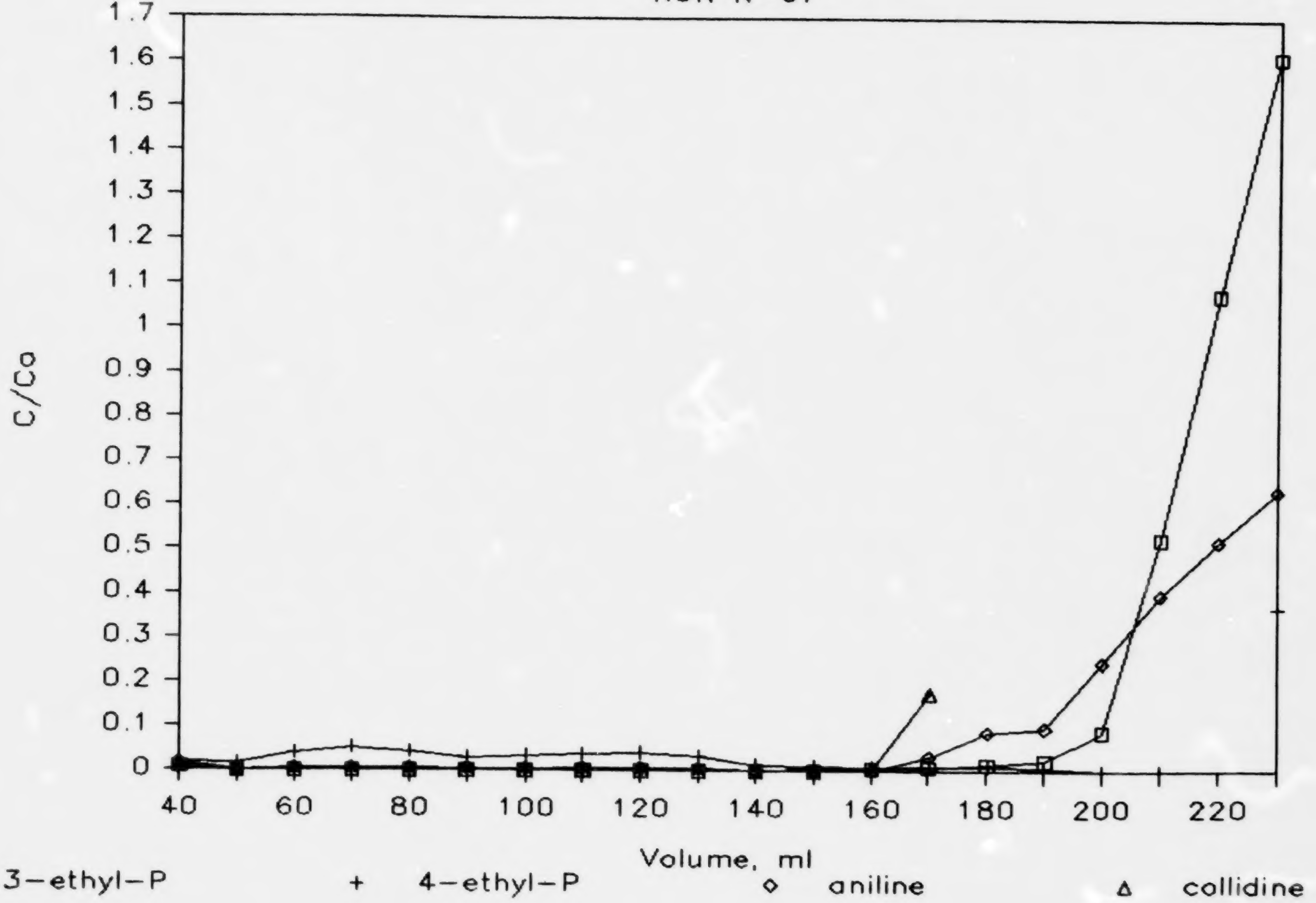
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–67

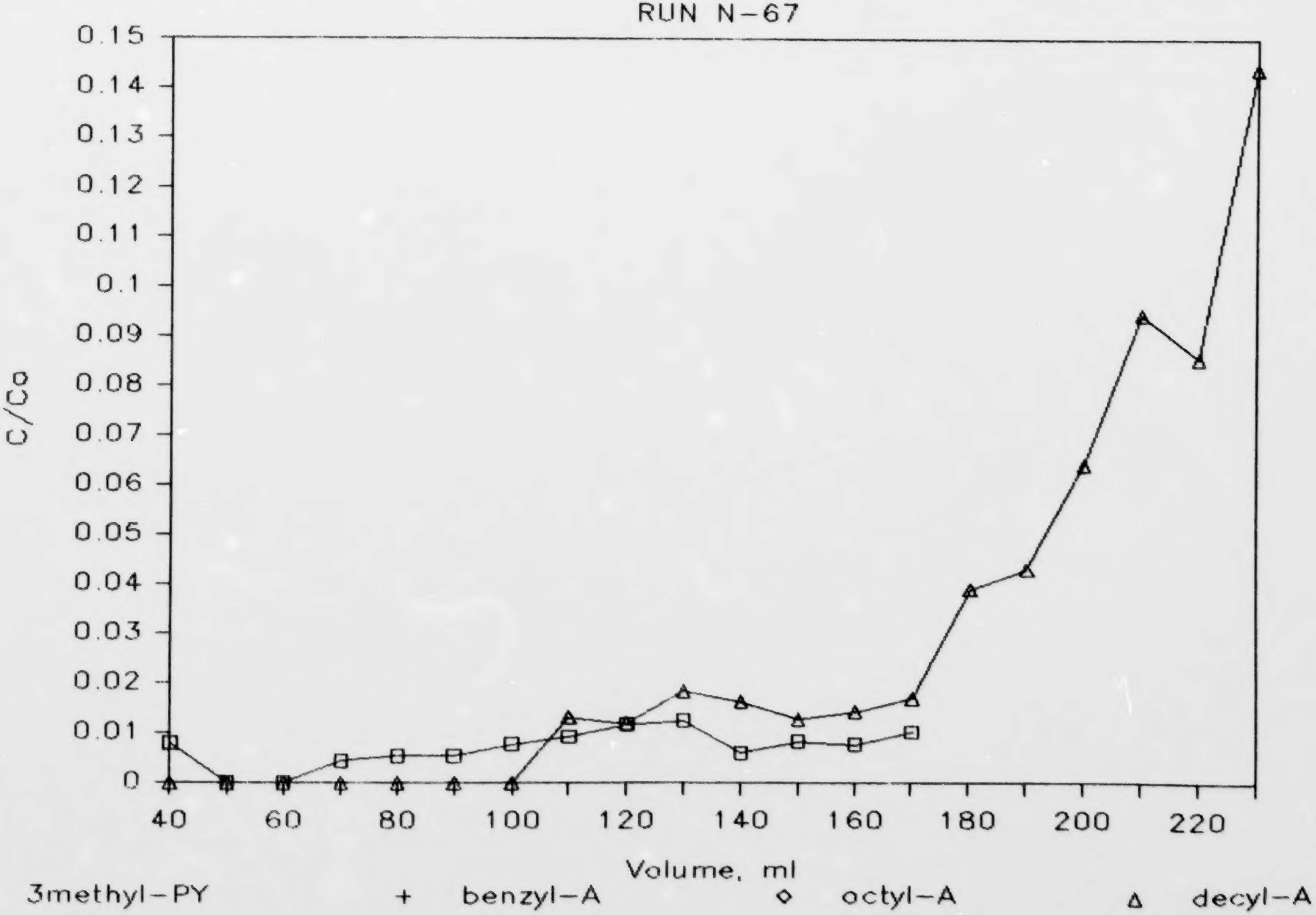


N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–67

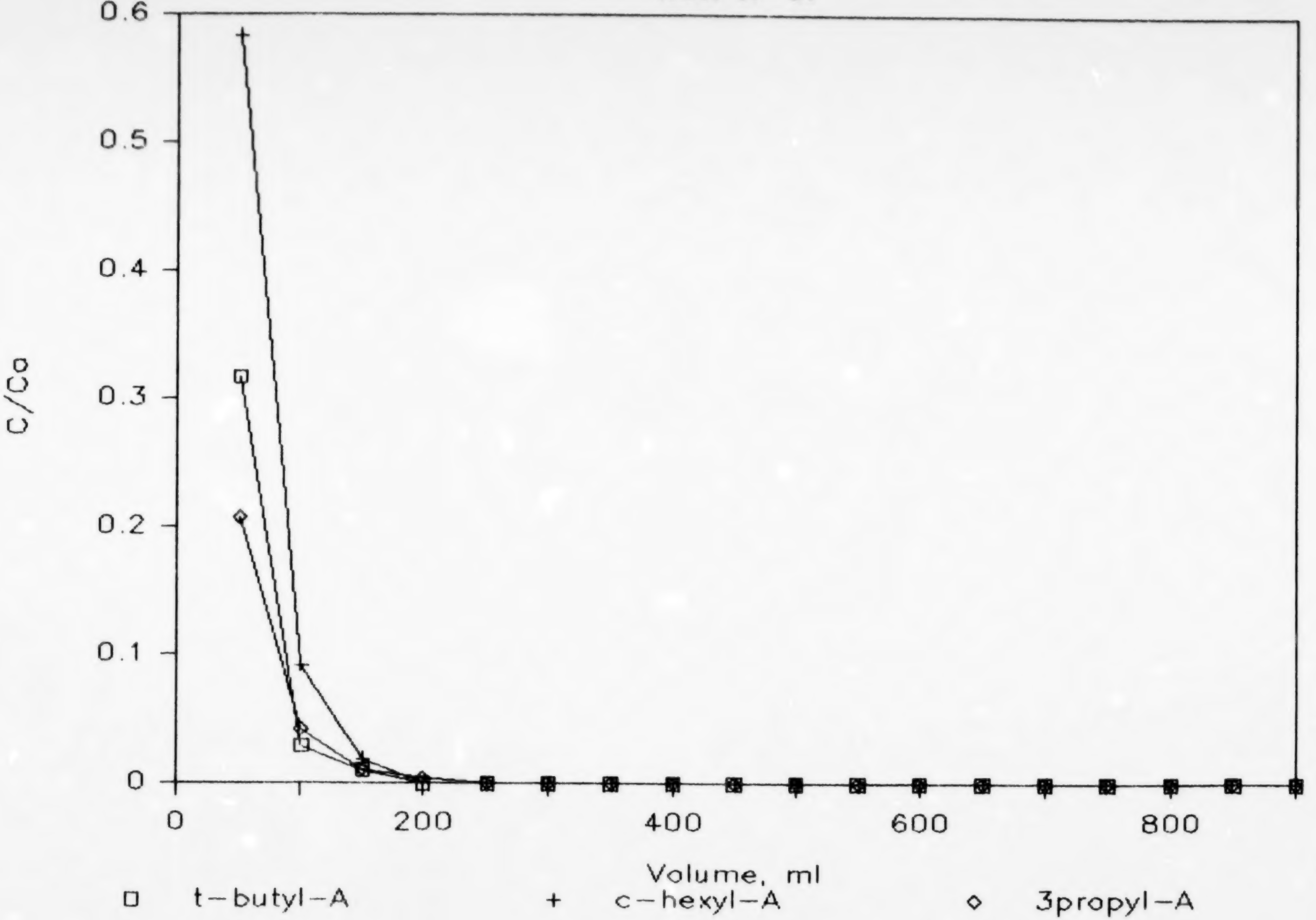


N-COMPOUNDS BREAKTHROUGH CURVES



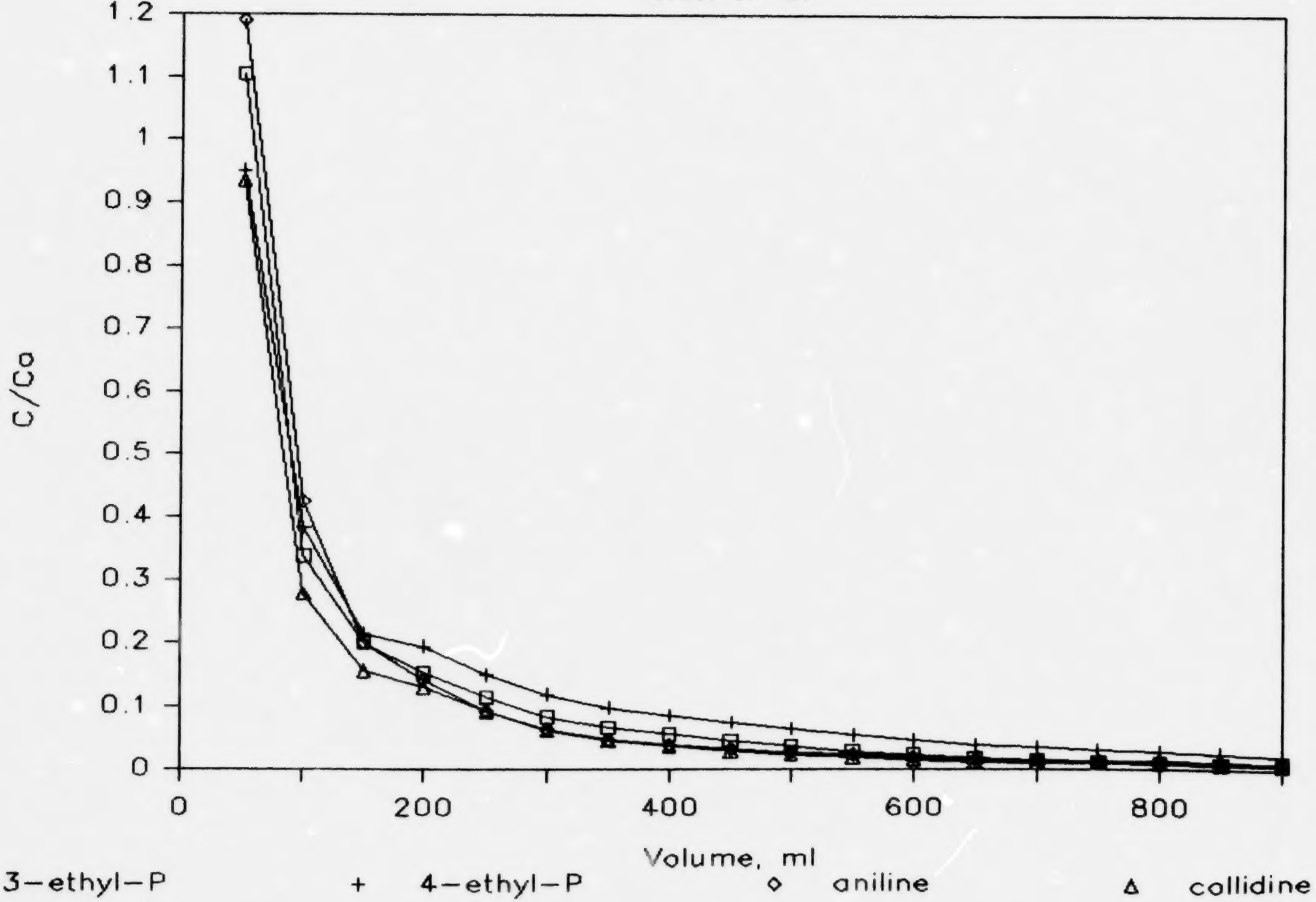
N-COMPOUNDS DESORPTION CURVES

RUN R-67



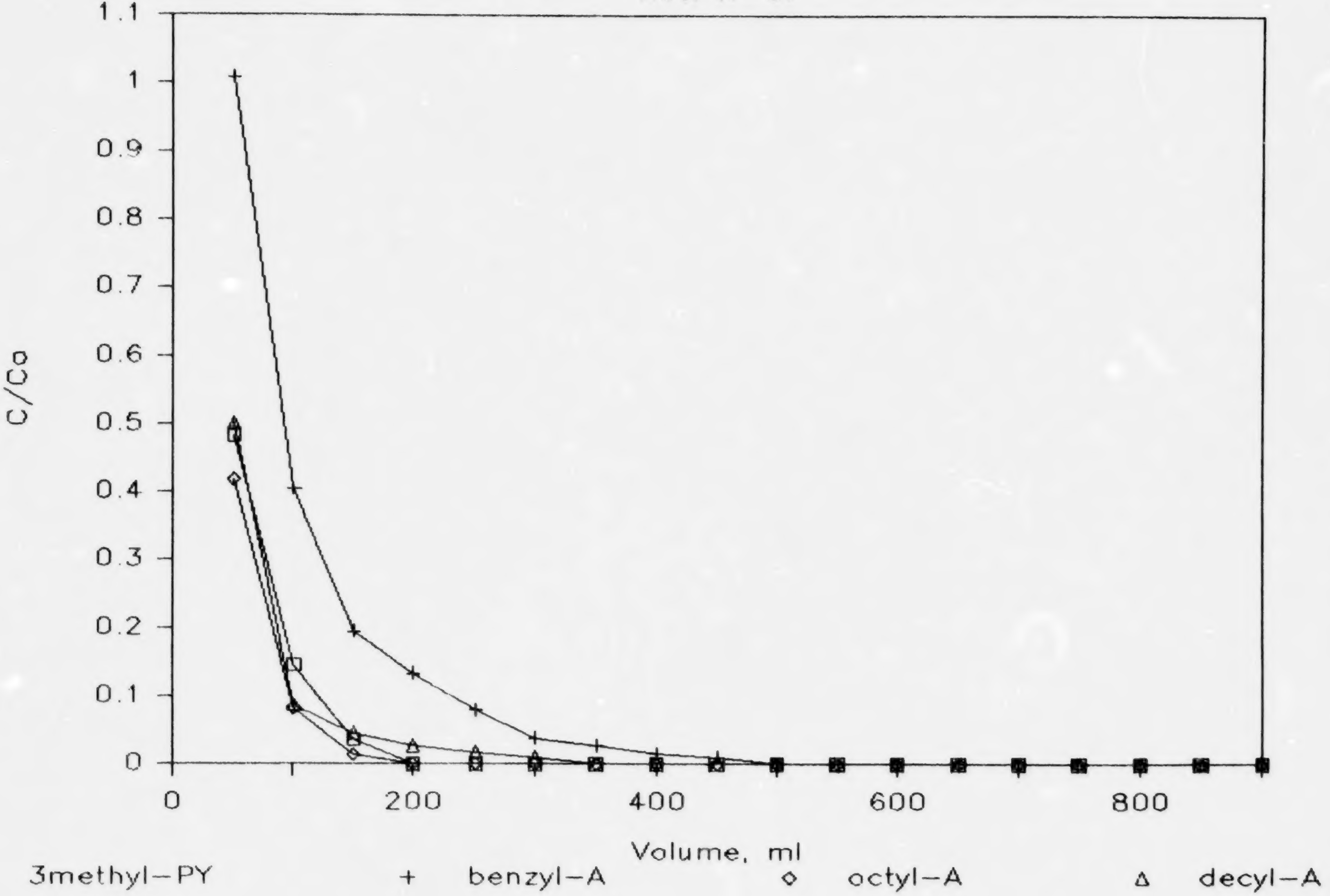
N-COMPOUNDS DESORPTION CURVES

RUN R-67



N-COMPOUNDS DESORPTION CURVES

RUN R-67



Run N-63: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.158349	0.008431	0	0.0077464	0.083372	0.052013	0.041316	0.017327	0.019572	0.022444	0.106241
6	60	0.021698	0	0	0.024043	0.055058	0.019016	0.019965	0.003954	0.014296		0.026037
7	70	0.023002	0	0	0.007963	0.09945	0.01663	0.009229	0	0.074208		0.022377
8	80	0.026025	0	0	0.007065	0.10757	0.016303	0.005943	0	0.081196		0.027767
9	90	0.019557	0	0	0.007824	0.095941	0.01417	0.005343	0.003696	0.147223		0
10	100	0.032136	0	0	0.003561	0.065576	0.009165	0.001984	0.004751	0.140872		0.009733
11	110	0.019268	0	0	0	0.062885	0.007356	0.002494	0.003661	0.086877		0
12	120	0.015302	0	0	0.008031	0.050133	0.006308	0.003417	0.011345	0.12754		0.018452
13	130	0.028763	0	0	0.011396	0.049735	0.013756	0.007567	0.017464	0.130191		0.016762
14	140	0.028323	0	0.002598	0.004833	0.023996	0.006581	0.007004	0.011122	0.061631		0.013887
15	150	0.025653	0	0.003406	0.00875	0.013206	0.01492	0.006596	0.010137	0.031052		0.021881
16	160	0.029476	0.026734	0.001555	0.003978	0.005639	0.006177	0.004763	0.005656	0.020023	0.016017	0.039418
17	170	0.623547	0.033521	0.012577	0.010962	0.016448	0.007834	0.025564	0.018666	0.012502	0.021477	0.042129
18	180	0.958145	0.023067	0.011443	0.009138	0.011704	0.073118	0.825676	0.007206	0.011821	0.011412	0.048925
20	200	0.953918	0	0.00862	0.010133	0.004703	0.224509			0	0	0.04344
21	210	1.047739	0	0.008945	0.078357	0.008644	0.49469			0	0	0.047684
22	220	1.042493	0	0.013485	0.807947	0.015689	0.646343			0	0	0.064564
23	230	0.827299	0.023045	0.015522	1.519844	0.059215	0.734663			0.004455	0	0.0888
24	240	0.634915	0.064303	0.016325	1.667915	0.125374	0.84506			0.01234	0	0.113147

Run R-63: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	1.06851	0.1816596	1.53464	1.22842	2.8738956	1.8255256	0.4988659	2.2843644	0.68147	0.49802
2	100	0	0.71489	0.38334	4.97778	6.68835	3.9715695	2.9098846	1.0708395	4.13312	0.49055	0.44168
3	150	0	0.71773	0.48583	3.29212	5.81664	2.555135	1.970489	0.9655648	2.11678	0.3039	0.12509
4	200	0	0.79385	0.72862	2.93122	5.84399	2.5826258	2.0177182	0.7815422	1.24827	0.3312	0.47917
5	250	0	1.00811	0.96579	3.55529	6.46521	2.2893822	2.2948772	0.7827558	0.97699	0.5872	0.307681
6	300	0	1.45222	1.09733	4.81187	8.0275	2.2141721	2.591471	0.8833628	1.00096	0.37526	0.45149
7	350	0	1.70155	0.98926	4.68599	7.78001	1.7775401	2.1664101	0.7490889	0.66839	0.48734	0.86878
8	400	0	2.02003	0.87586	4.50771	7.93681	1.5975816	1.9600998	0.696903	0.60409	0	0
9	450	0	2.69508	0.84289	5.08912	9.74596	1.8668057	2.2153853	0.8765605	0	0	0
10	500	0	2.73652	0.71899	4.15227	8.48725	1.5555182	1.7898128	0.7144287	0	0	0
11	550	0	3.30567	0.6680395	4.2755484	9.5231274	1.7905313	1.9000779	0.8712586	0	0	0
12	600	0	3.21965	0.5615	3.51285	8.41693	1.3912858	1.5767602	0.7653549	0	0	0
13	650	0	3.02036	0.49063	2.76439	7.0619	1.1967071	1.2470248	0.6397828	0	0	0
14	700	0	3.27588	0	2.69438	7.46992	1.3527529	1.3149415	0	0	0	0
15	750	0	3.20436	0	2.37598	6.86854	1.4330065	1.1951557	0	0	0	0
16	800	0	3.23572	0	2.15182	6.5281	1.1995695	1.0808521	0	0	0	0
17	850	0	3.91392	0	2.39662	7.72842	1.5757265	1.21231	0	0	0	0
18	900	0	0.27042	0.03498	0.13344	0.34821	0.0985025	0.0762533	0.146329	0	0	0

Run N-68: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0.050758	0	0.017684	0.013885	0.052033	0.029853	0.019859	0.024758	0.01357	0.010316	0.018422
4	40	0.074815	0	0.006613	0	0	0.016615	0.006534	0.00937	0.006669		0
5	50	0.005253	0	0.003626	0	0	0.007423	0	0			0
6	60	0.008674	0	0.003169	0	0	0.006026	0	0.002771			0
7	70	0.005217	0	0.003587	0	0	0.005829	0	0.003816			0
8	80	0.003915	0	0.002493	0	0	0.004559	0	0.004388			0.005473
9	90	0.003899	0	0	0	0	0.003841	0	0.004367			0.005883
10	100	0	0	0	0	0	0.003029	0	0.004512			0.007014
11	110	0.004987	0	0	0	0	0.002502	0	0.004272			0.007455
12	120	0.003068	0	0	0	0	0.003028	0	0.005226			0.009167
13	130	0	0	0	0	0	0	0.002004	0.004542			0.011204
14	140	0.198191	0	0.00196	0.004356	0.003148	0	0.005069	0.002349	0	0	0.015237
15	150	1.291783	0	0	0.006376	0.007793	0.00497	0.010844	0.004957	0	0	0.015841
16	160	1.144144	0	0	0.009542	0.006899	0.038656			0	0	0.03244
17	170	1.065005	0	0.004786	0.010208	0.005477	0.238371				0	0.059049
18	180	0.884505	0	0.004652	0.027131	0.010329	0.487349				0.010543	0.073958
19	190	0.460999	0	0.004531	0.087944	0.032565	0.512735				0.018802	0.110072
20	200	0.625227	0	0.003106			0.478952				0.009857	0.080626
21	210	0.481352	0	0.003823			0.737234				0.012166	0.128522
22	220	0.520388	0.055996	0.006195	1.39142	0.271253	0.622464				0.02173	0.133698
23	230	0.417877	0.231302	0.013754	1.516122	0.427724	0.689644				0.014222	0.162807
24	240	0.394245	0.364977	0.020355	1.169504	0.444449	0.549539				0.021473	0.116255
25	DEP	0.331739	0.273137	0.033043	0.792782	0.486315	0.441989				0.009949	0.081157

Run R-68: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	1.62942	0.52916	4.8205916	4.8192756	4.4340646	2.7168496	1.0285396	5.23084	0.9238	0.86818
2	100	0	2.03741	0.62419	6.5433	8.55615	4.81219	3.65768	1.28255	3.29246	0.48891	0.9208
3	150	0	2.16825	0.61208	4.84237	8.17976	3.5941039	2.7340136	0.9166371	1.19192	0.33291	0.30345
4	200	0	2.4473	0.69722	3.61593	7.19998	2.8286552	2.2963167	1.002163	0.42327	0	0
5	250	0	4.21561	0.80502	4.28247	8.74666	2.904907	2.5553121	1.0262397	0	0	0
6	300	0	4.09749	0.60897	3.23974	6.63918	1.8022328	1.8176254	0.7140793	0	0	0
7	350	0	0.92614	0.10147	0.54074	1.29428	0.4218757	0.3545214	0.1505746	0	0	0
8	400	0	0	0	0.71056	1.97329	0.881012	0.558654	0.2072244	0	0	0
9	450	0	0	0	0.32644	1.27742	0.3724704	0.2812	0	0	0	0
10	500	0	0	0	0.21989	1.00405	0.3630512	0.20922	0	0	0	0
11	550	0	0	0	0	0.68038	0.2149372	0.14336	0	0	0	0
12	600	0	0	0	0	0.59348	0.2124262	0.12867	0	0	0	0
13	650	0	0	0	0	0.47035	0.1867293	0.11147	0	0	0	0
14	700	0	0	0	0	0.38062	0.1651112	0.09678	0	0	0	0
15	750	0	0	0	0	0.27733	0	0	0	0	0	0
16	800	0	0	0	0	0.23086	0	0	0	0	0	0
17	850	0	0	0	0	0	0	0	0	0	0	0
18	900	0	0	0	0	0	0	0	0	0	0	0

Run N-69: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

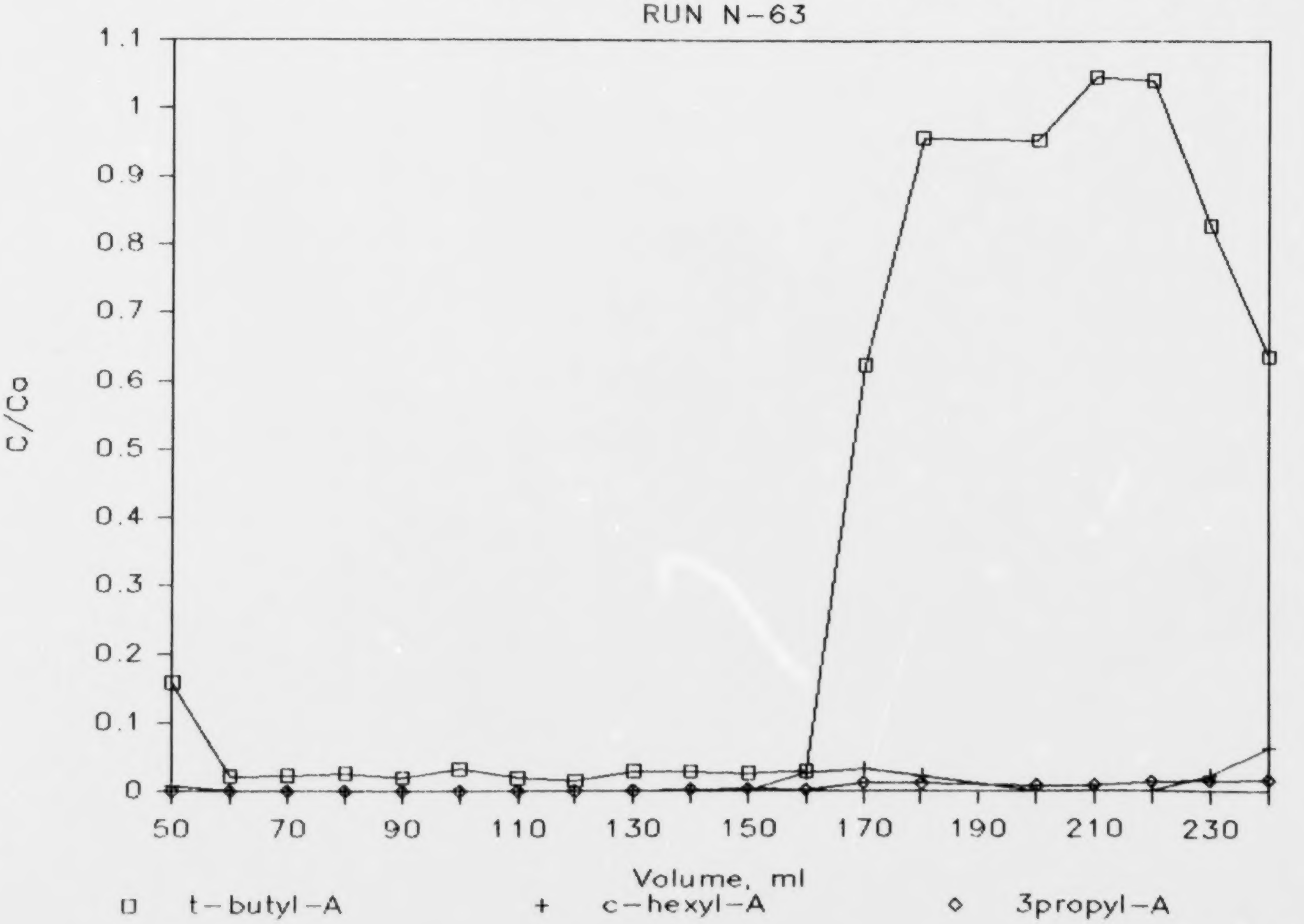
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0		0	0
2	20		0.354294	0.264889	0.172108	0.378878	0.24151	0.164453	0.219611		0.410288	0.25985
3	30	1.233827	0.009109	0.232014	0.047815	0.540192	0.09507	0.002817	0.035725		0.76615	0.157138
4	40	1.248695	0	0.135075	0	0.266343	0.034885	0	0.009597		1.946193	0.890484
5	50	0.440491	0	0.089995	0	0.151573	0.018786	0	0.007462		2.42486	1.007594
6	60	0.446147	0	0.04929	0	0.076572	0.008456	0	0.00803		2.0974298	0.682229
7	70	0.515299	0	0.029894	0	0.046443	0.00577	0	0.007696		1.747409	0.403314
8	80		0	0.019333	0	0.039127	0.005423	0	0.011334		1.422264	0.234448
9	90		0	0.012626	0	0.041273	0.005966	0	0.016045		1.108372	0.145415
10	100		0	0.00893	0	0.035317	0.006877	0	0.017904		0.567075	0.105956
11	110		0	0.012488	0.003915	0.017625	0.007011	0.008919	0.011045		0.042229	0.022003
12	120	0.119943	0	0.012728	0.004157	0.010205	0	0.007834	0.006564		0.015377	0.056195
13	130	0.106593	0	0.016322	0.006035	0.008795	0	0.006025	0.007909		0.008593	0.018571
14	140	0.46493	0	0.017901	0.010084	0.011681	0.015838	0.018995	0.019448		0.009263	0.05043
15	150	0.534614	0	0.013095	0.015251	0.010219	0.047925	0.582814	0.029373		0.014432	0.054754
16	160	0.423876	0	0.006702	0.017175	0.005451	0.089639				0.009799	0.05104
17	170	0.429266	0	0.011271	0.031782	0.01291	0.250264				0.099834	0.08895
18	180	0.397982	0	0.013993	0.189266	0.028934	0.436395				0.076568	0.069298
19	190	0.340618	0	0.019469	0.879124	0	0.510185				0.238019	0.14841
20	200	0.384824	0	0.018826	1.484078	0	0.552838				0.017163	0.060839
21	210	0.322892	0	0.030969	1.53376	0.244156	0.607143				0.296368	0.150109
22	220	0.36846	0.042527	0.034252	1.476264	0.383716	0.587333				0.281844	0.172023
23	230	0.435075	0.058269	0.017654	1.375819	0.497822	0.595093				0.274149	0.176029
24	240	0.352665	0.100735	0.019388	1.265646	0.645805	0.542733				0.224728	0.140382
25	DEP	0.443014	0.108721	0.042181	1.538954	0.984323	0.680613				0.344992	0.227035

2

Run R-69: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

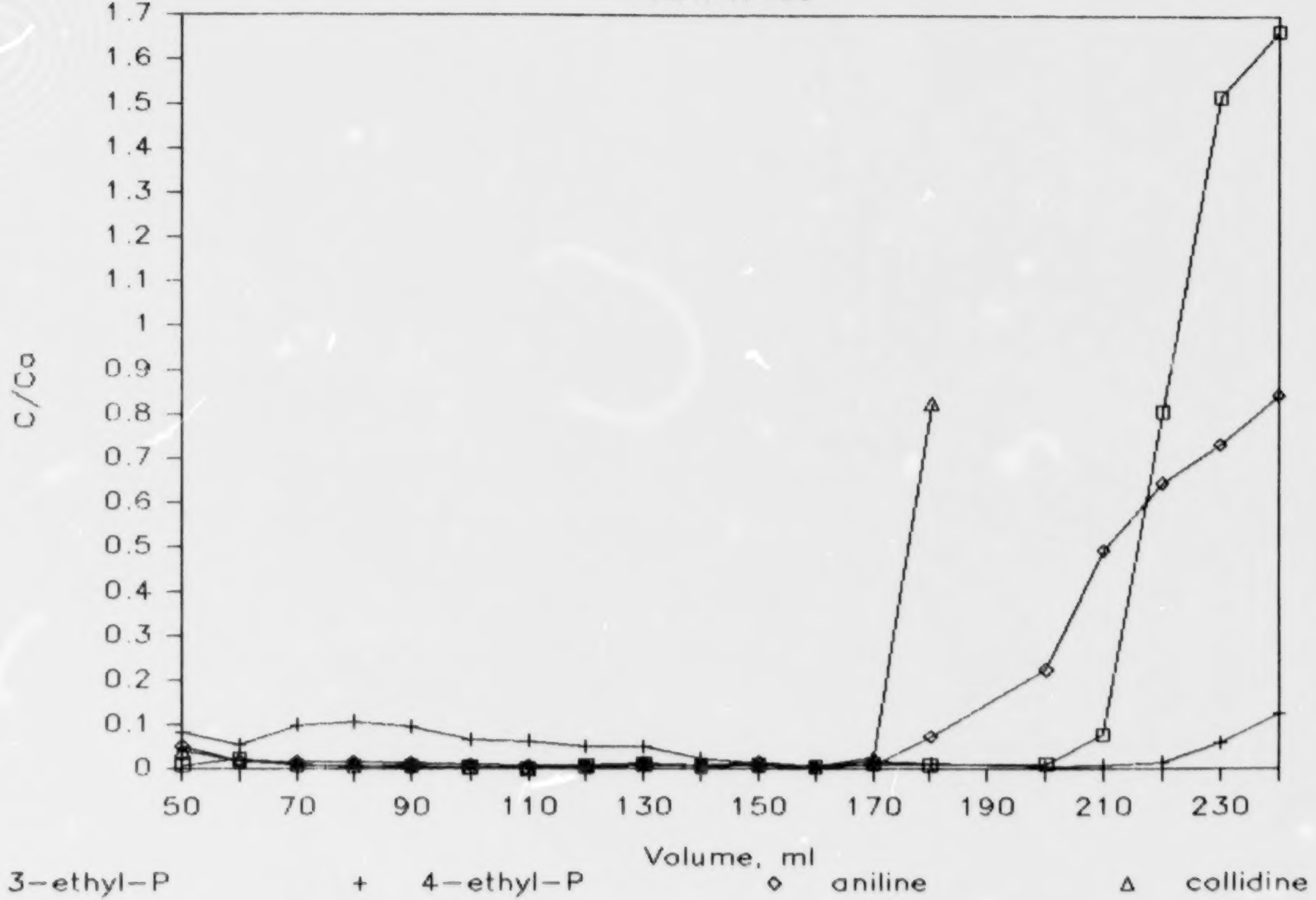
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	1.64045	0.8426235	6.124831	5.7746762	5.4630826	3.2903706	0.0396307	6.993167	0.78185	0.66284
2	100	0	1.85545	0.50717	9.63404	16.0773	7.6078417	4.7729416	1.853606	4.041789	0.89125	3.6975
3	150	0	2.04215	0.624662	6.85321	15.3644	6.6117449	4.1663088	1.3227207	1.91942	0	1.94195
4	200	0	2.27244	0.6877254	5.18435	12.6305	4.5649799	3.6216526	1.1575766	2.5325	0	1.43024
5	250	0	2.8212325	0.601201	5.26323	12.4193	4.3741563	3.3811887	1.2698947	3.3114982	0	1.21528
6	300	0	3.0519139	0.58296	4.69754	11.6089	4.0634174	2.9262068	1.2662812	3.740543	0	1.24859
7	350	0	3.1728695	0	3.90229	11.2696	4.085806	2.7085616	1.1988377	4.25978	0	1.14335
8	400	0	3.3436634	0	3.39934	11.2737	4.1492791	2.6677634	1.2574344	5.09217	0	1.31548
9	450	0	0	0	3.19751	11.1854	4.9102815	2.9485229	1.3778379	5.43469	0	1.45102
10	500	0	0	0	2.31699	9.71703	4.1757371	2.5264131	1.2674783	5.57705	0	0
11	550	0	0	0	1.77967	8.131907	3.545836	2.1233274	0	4.49477	0	0
12	600	0	0	0	0	5.26964	2.5473557	1.52649	0	3.00851	0	0
13	650	0	0	0	0	3.82091	2.6700776	1.22172	0	2.5596	0	0
14	700	0	0	0	0	0.88629	0.5725587	0.4460572	0.3283579	2.1501378	0	0
15	750	0	0	0	0	0	0	0	0	0	0	0
16	800	0	0.4011	0.14539	0.52638	0.57651	0.3655523	0.5598258	1.0696	0	0	0.13763
17	850	0	0	0	1.33494	1.78589	1.6414321	1.7352254	0.5547356	4.61204	0.199442	1.33704
18	900	0	0	0	2.39833	3.94127	6.2488335	3.3559379	0.13763	3.7240762	0	2.42753

N-COMPOUNDS BREAKTHROUGH CURVES



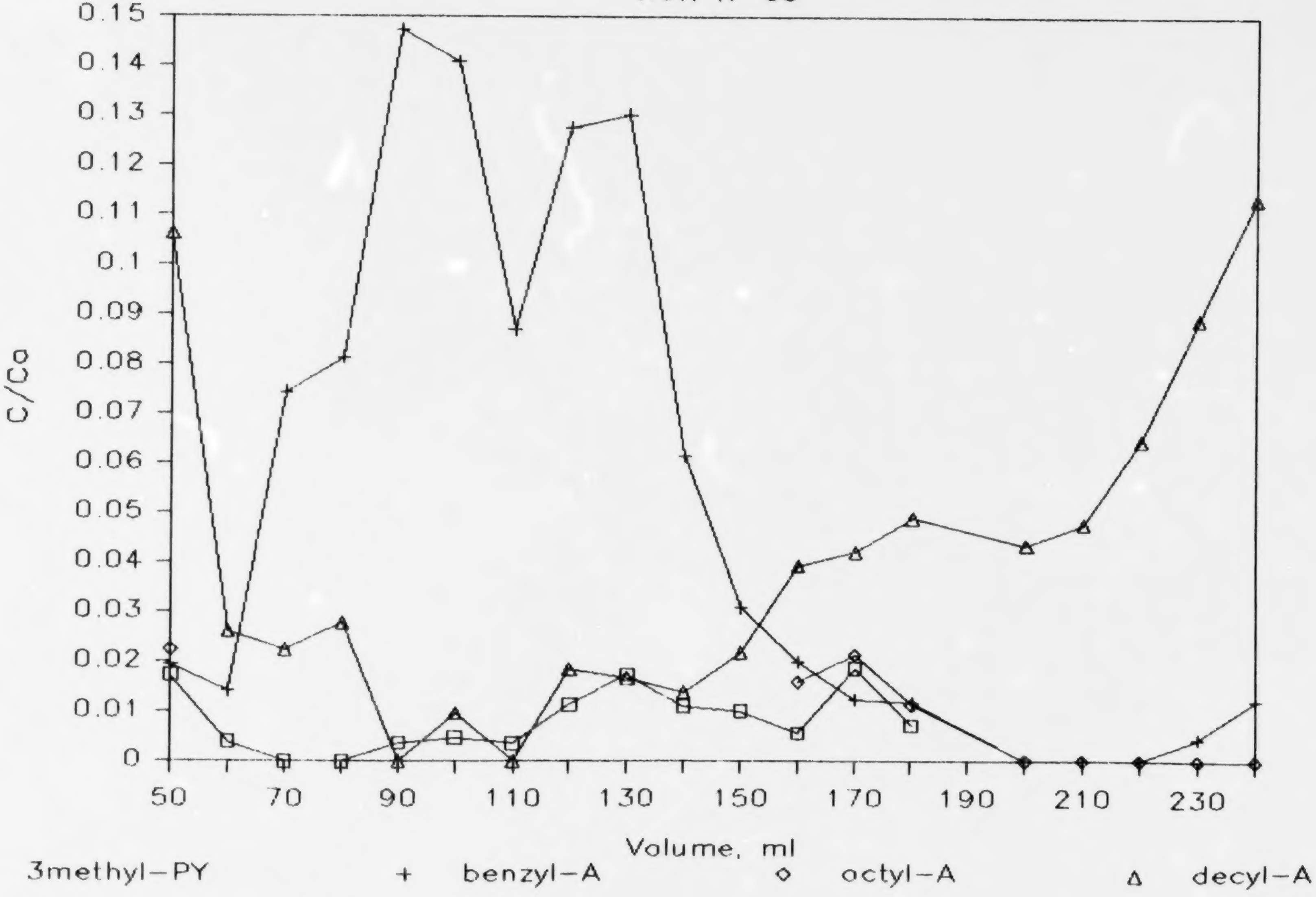
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-63



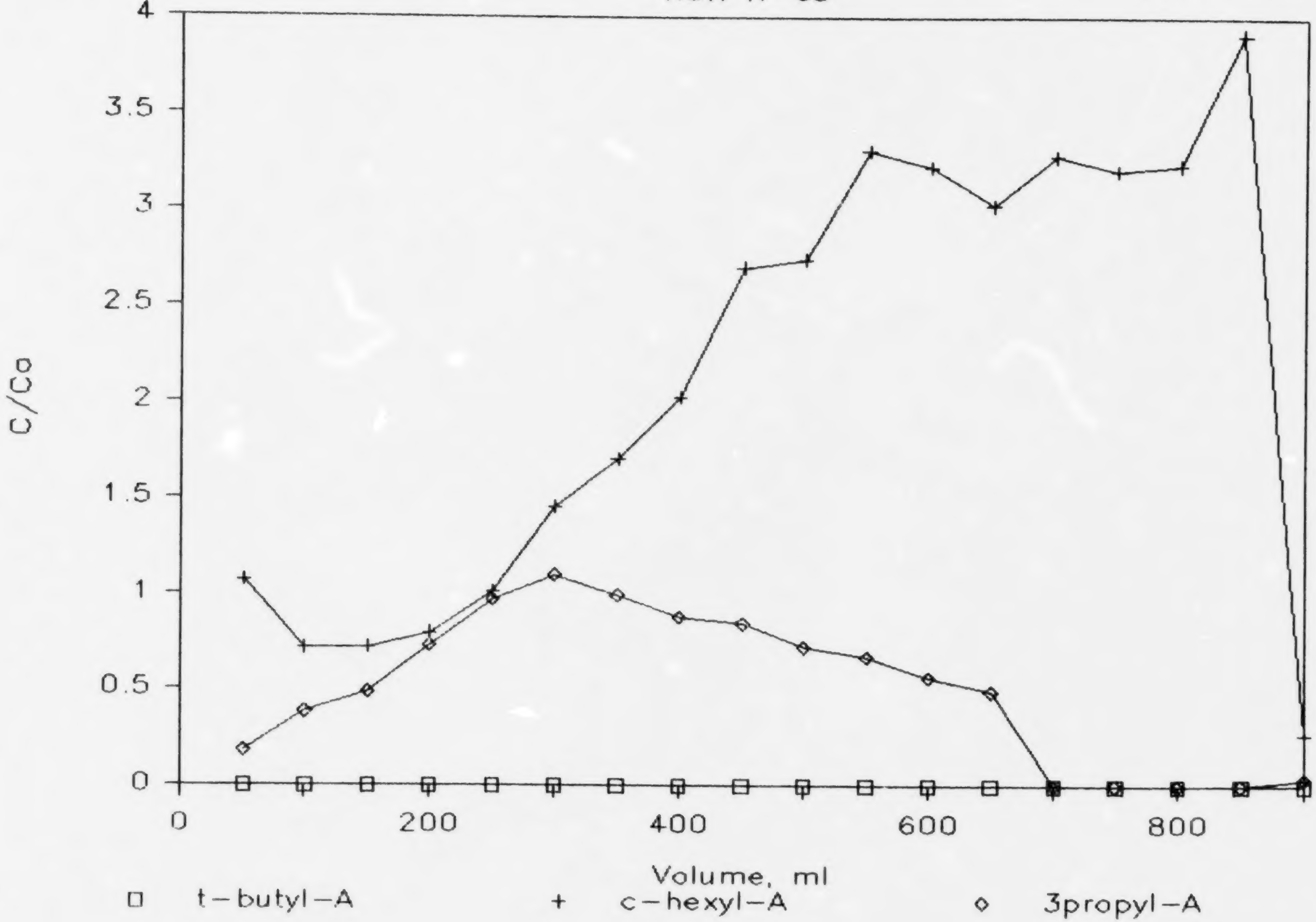
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-63



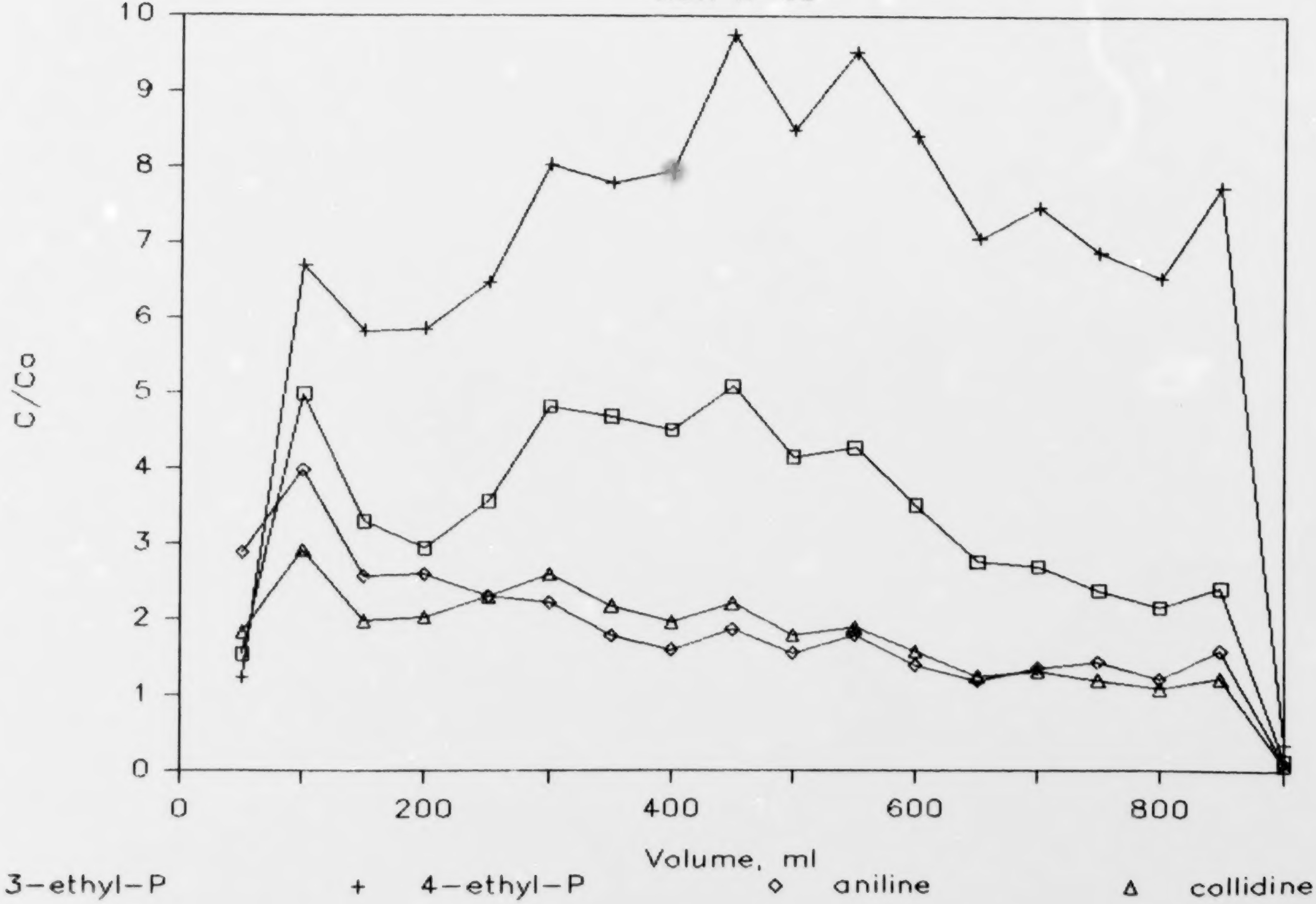
N-COMPOUNDS DESORPTION CURVES

RUN R-63



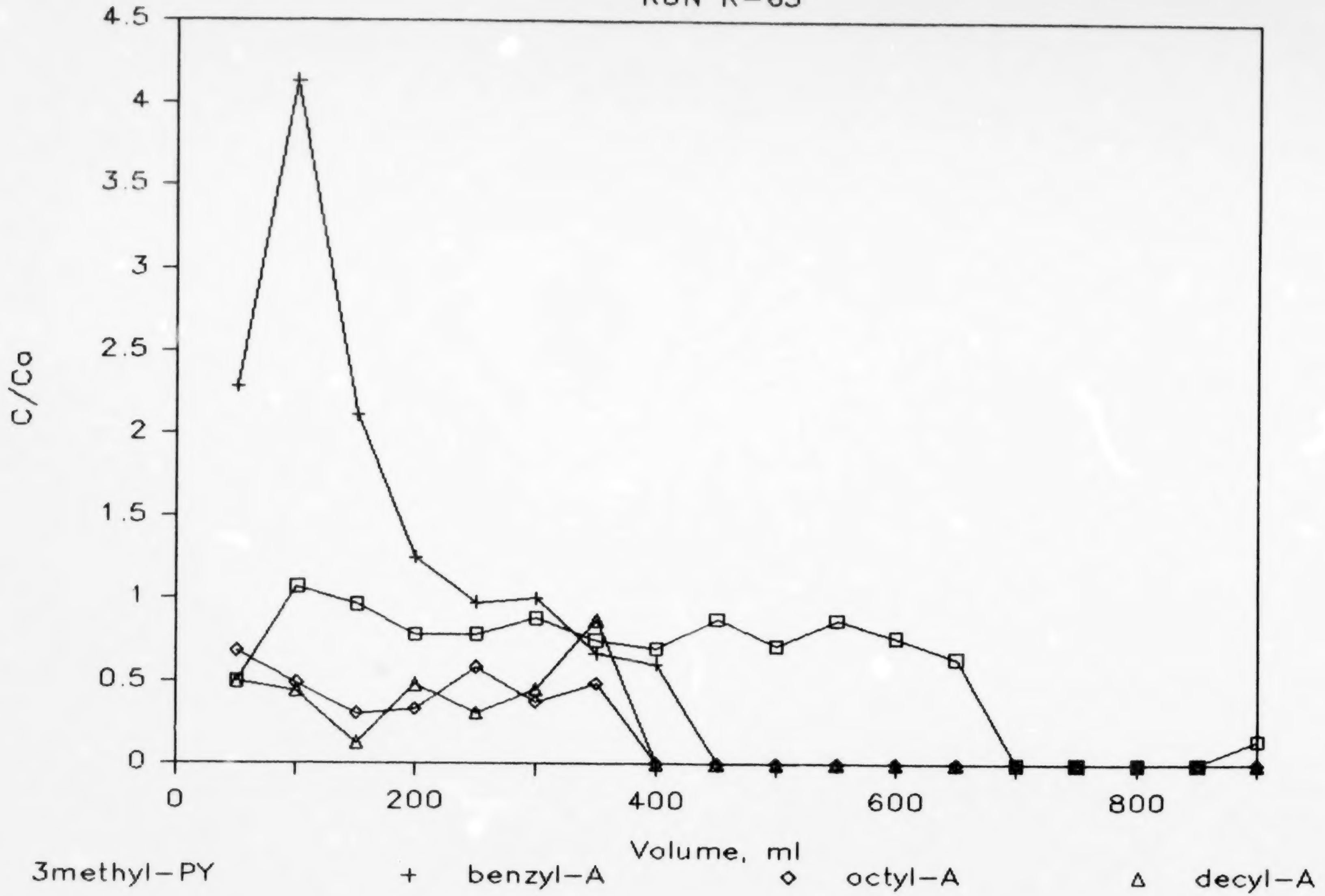
N-COMPOUNDS DESORPTION CURVES

RUN R-63



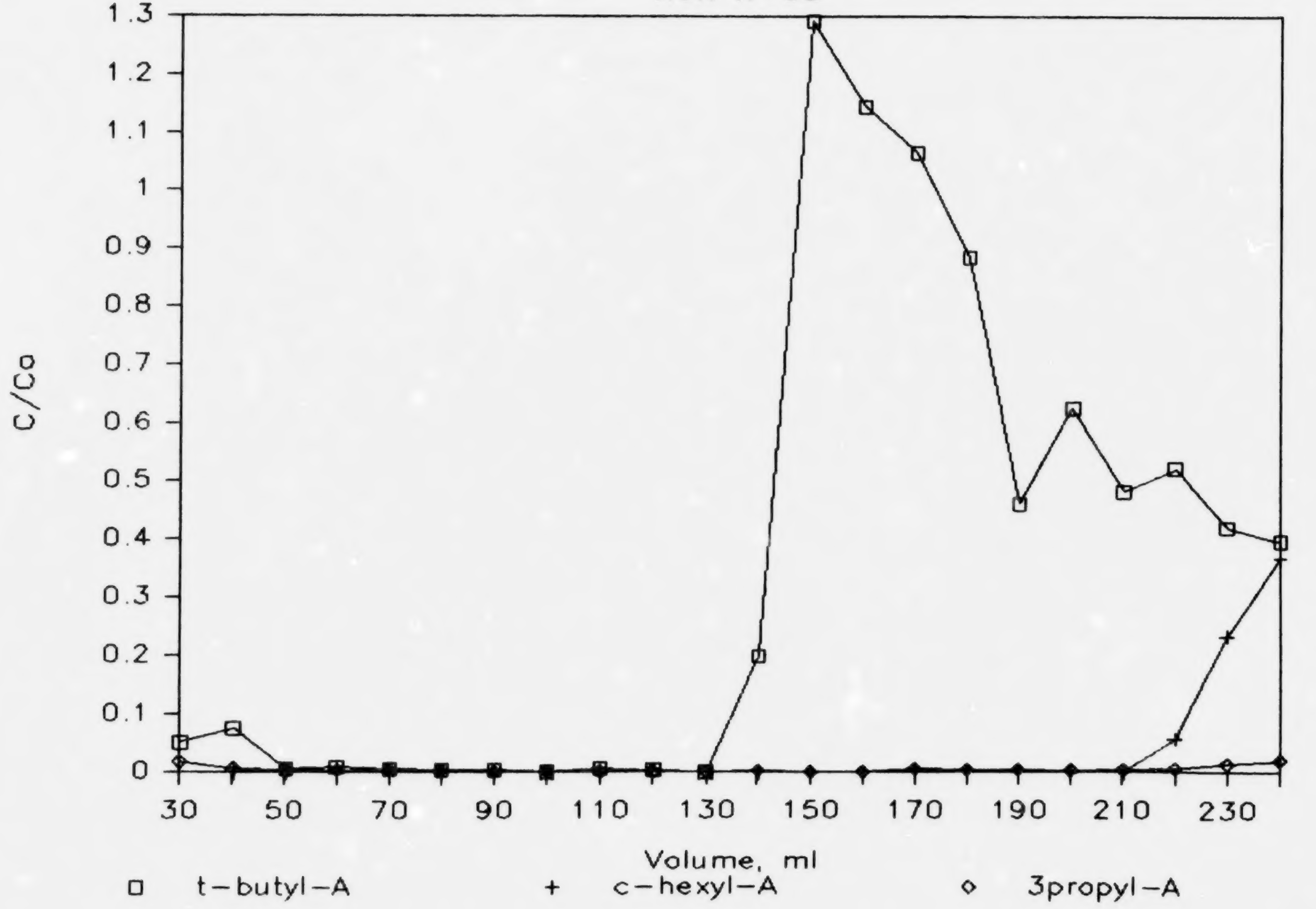
N–COMPOUNDS DESORPTION CURVES

RUN R–63



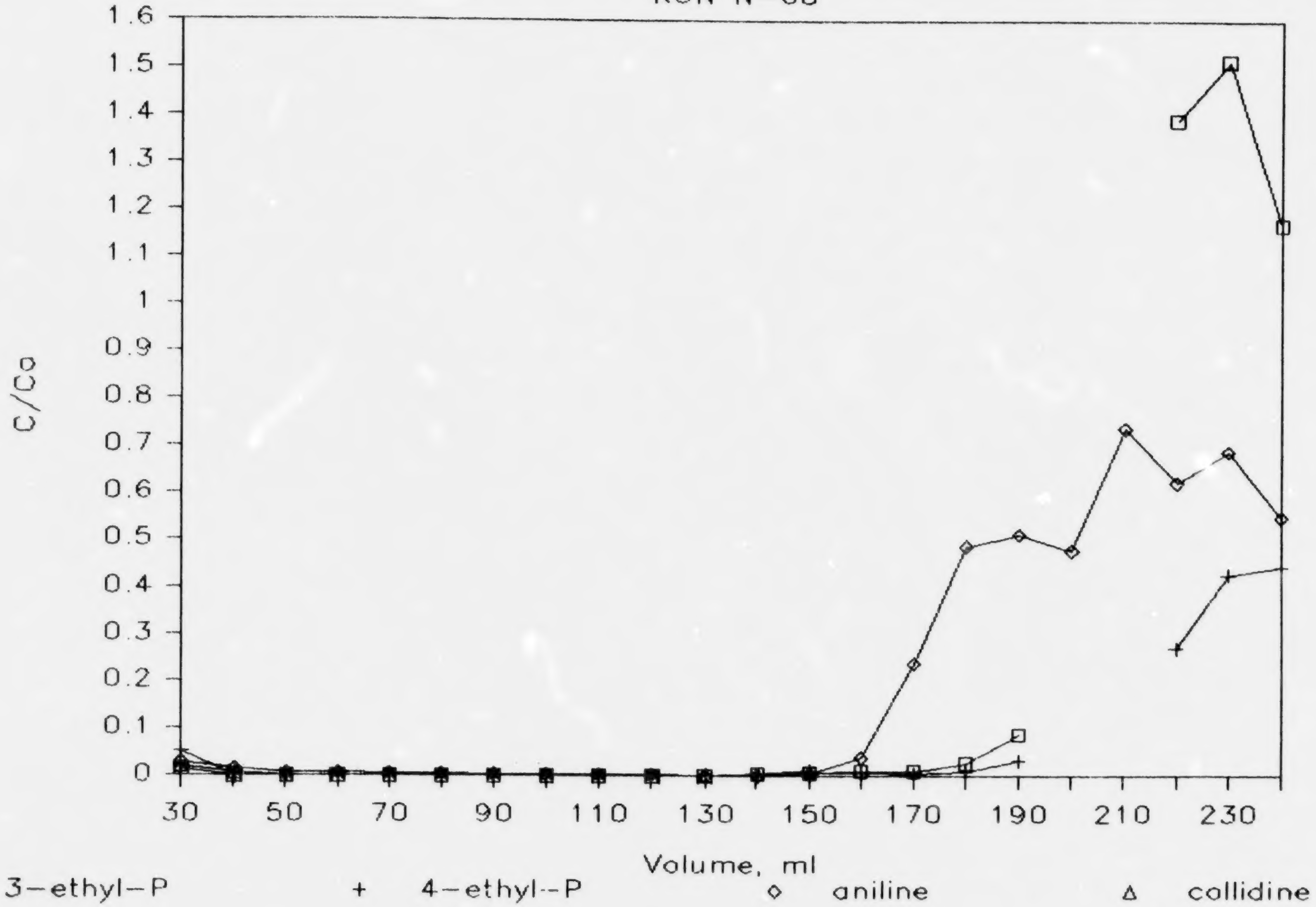
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-68



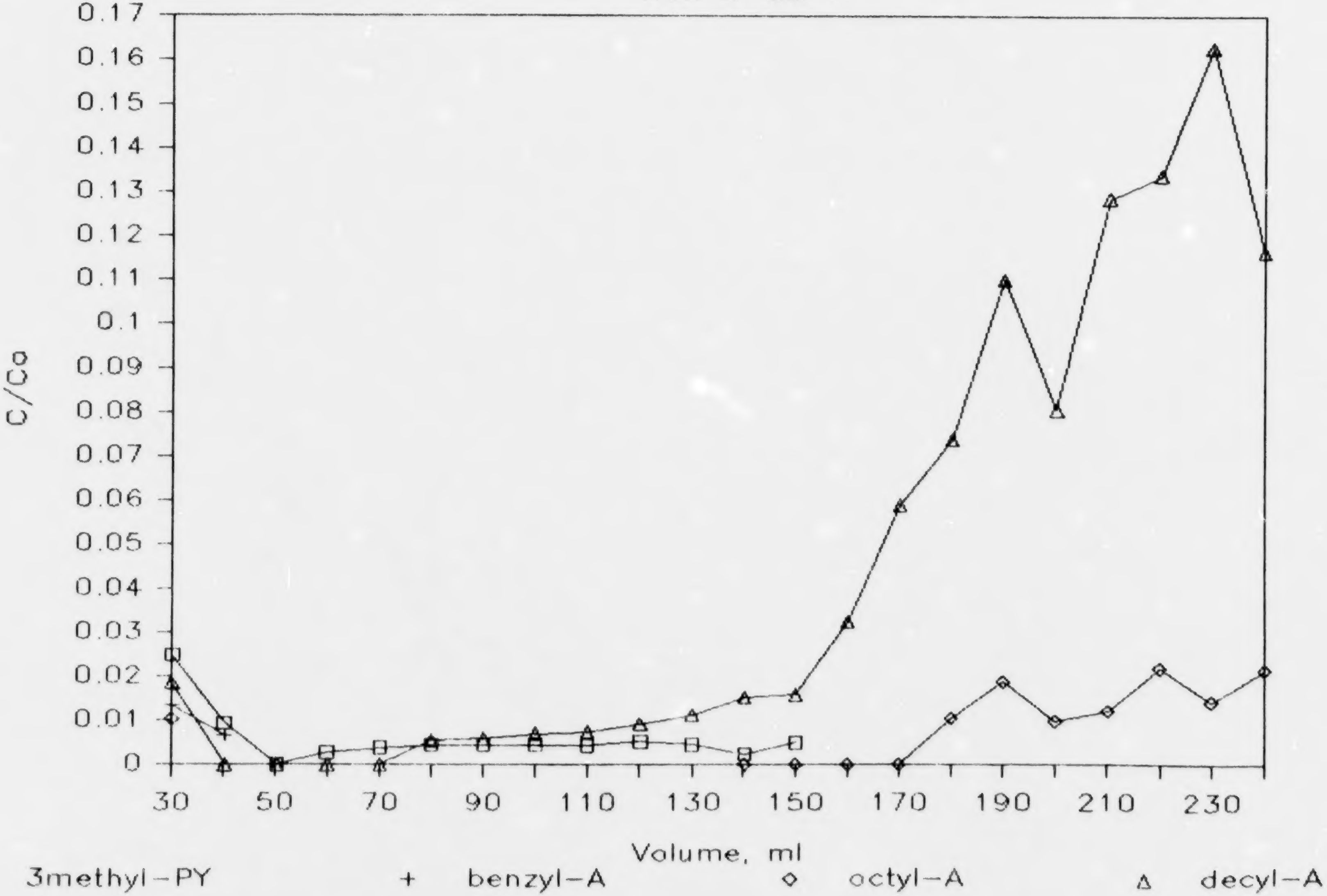
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–68



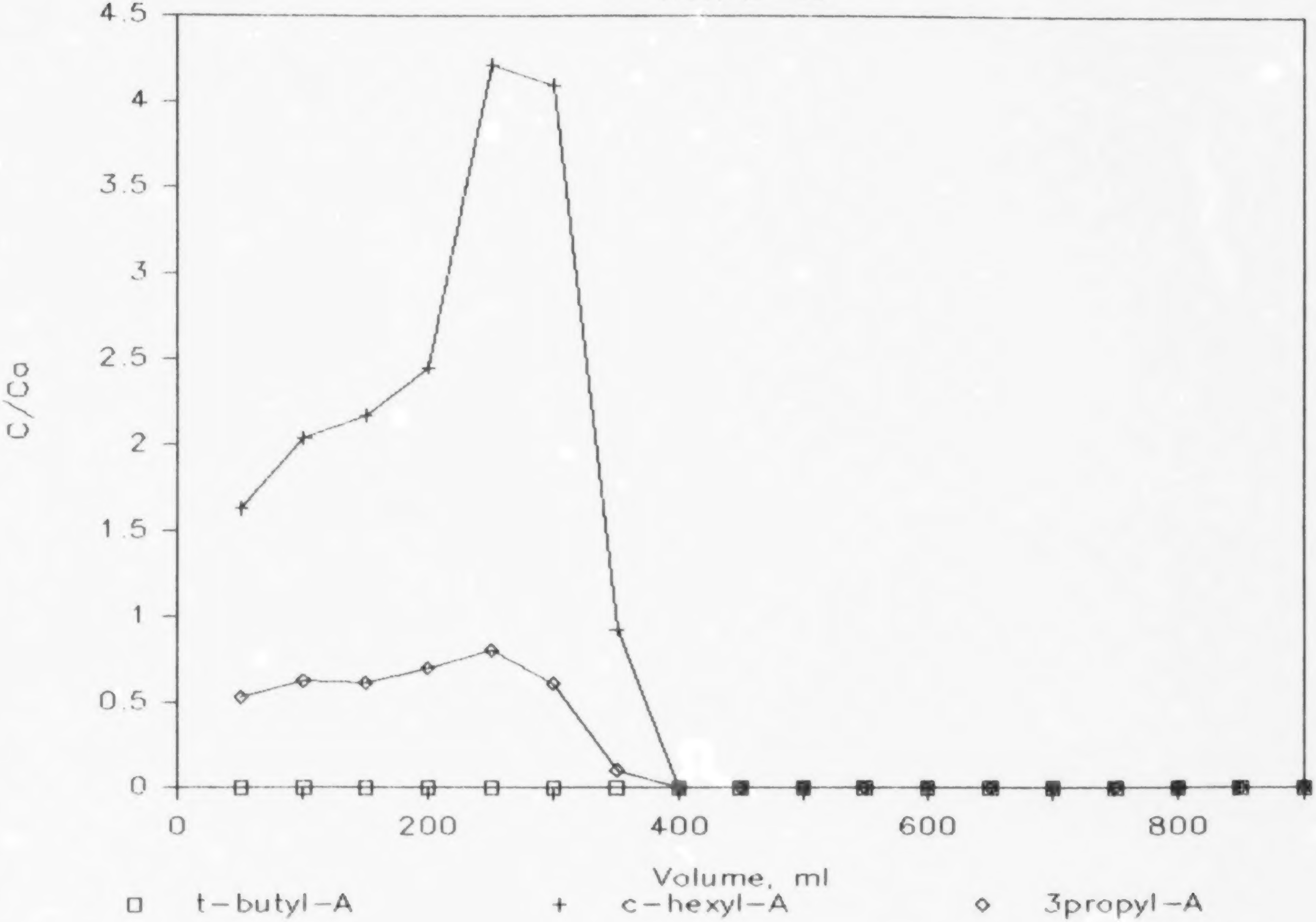
N–COMPOUNDS BREAKTHROUGH CURVES

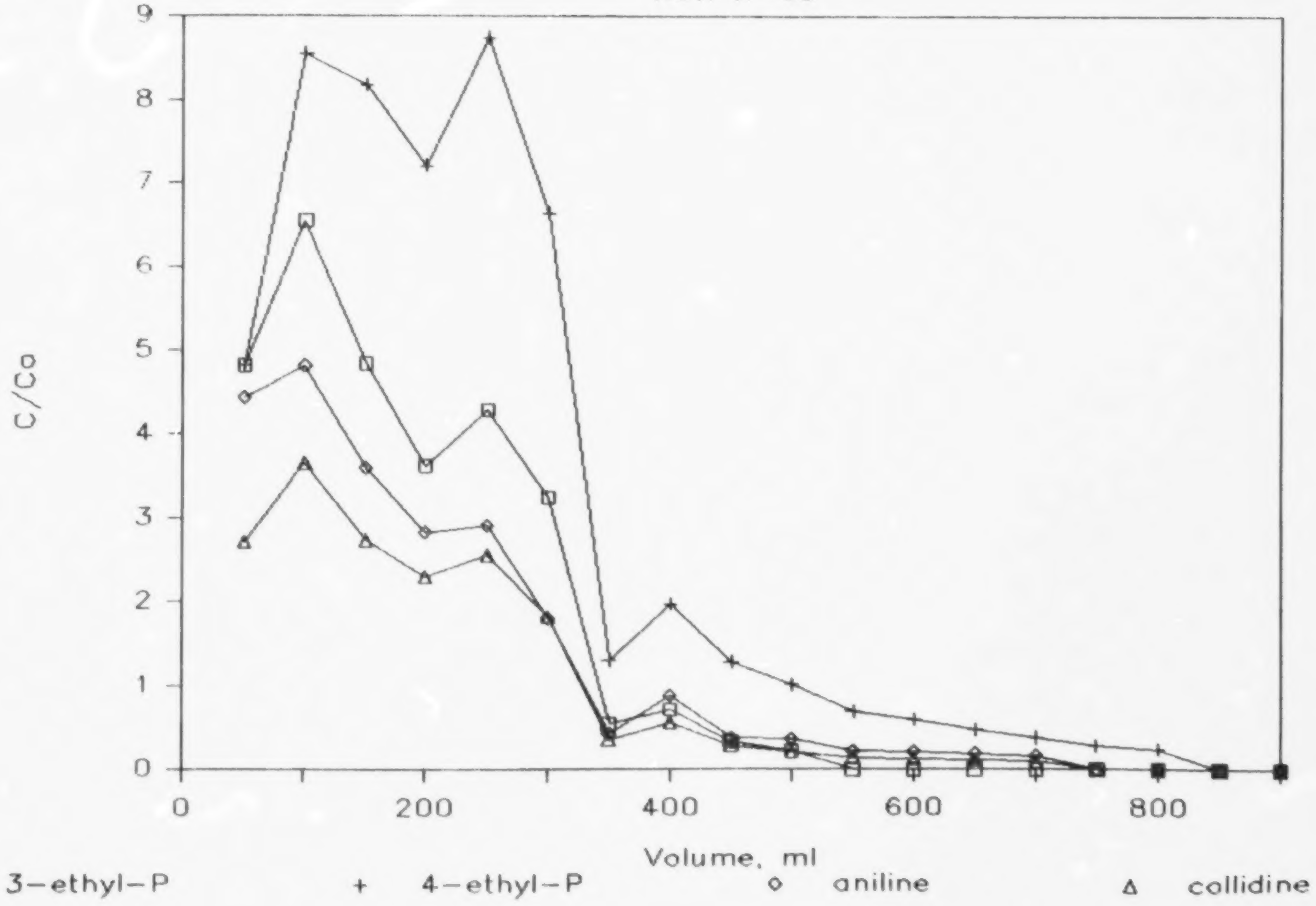
RUN N–68



N-COMPOUNDS DESORPTION CURVES

RUN R-68

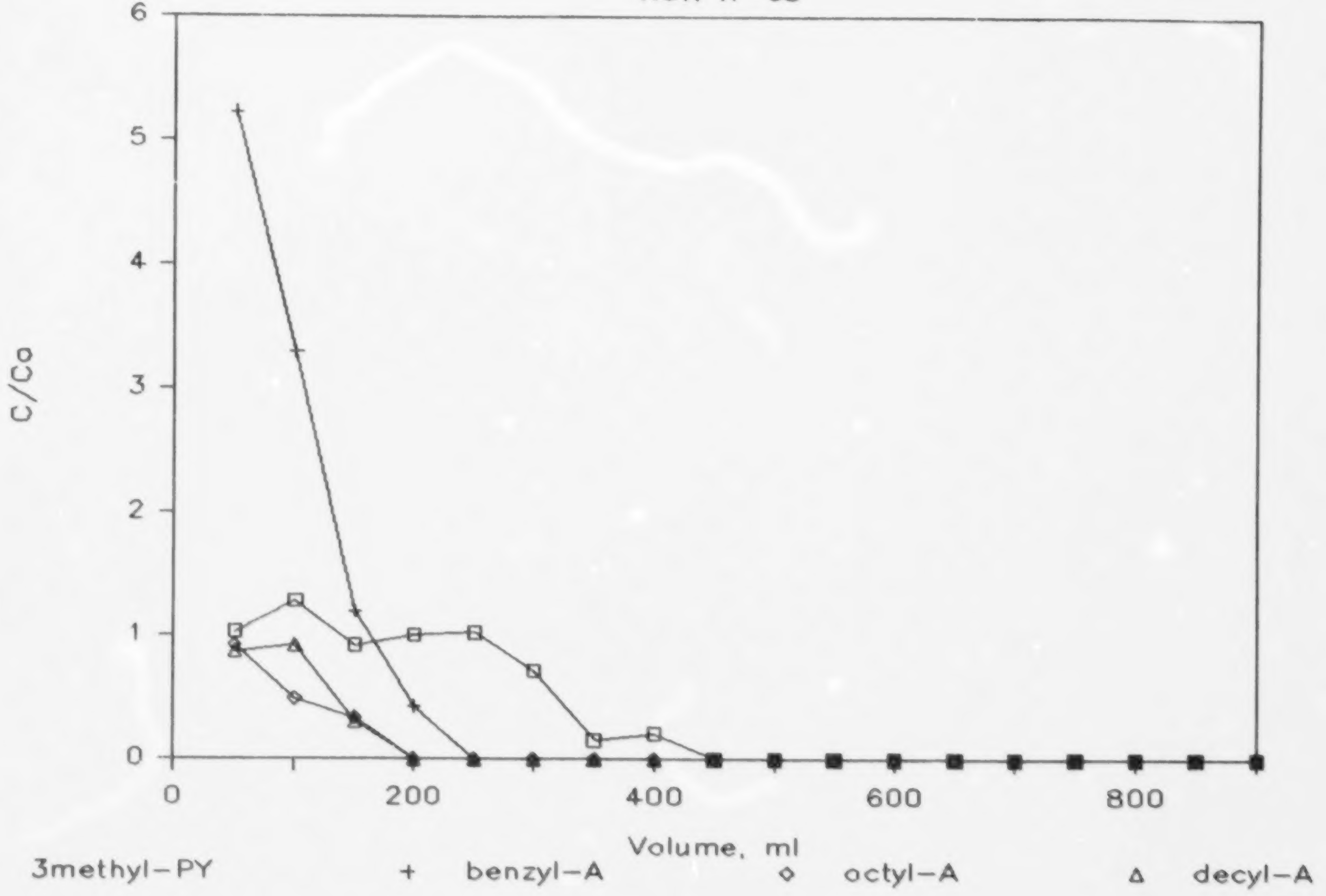



N-COMPOUNDS DESORPTION CURVES

RUN R-68

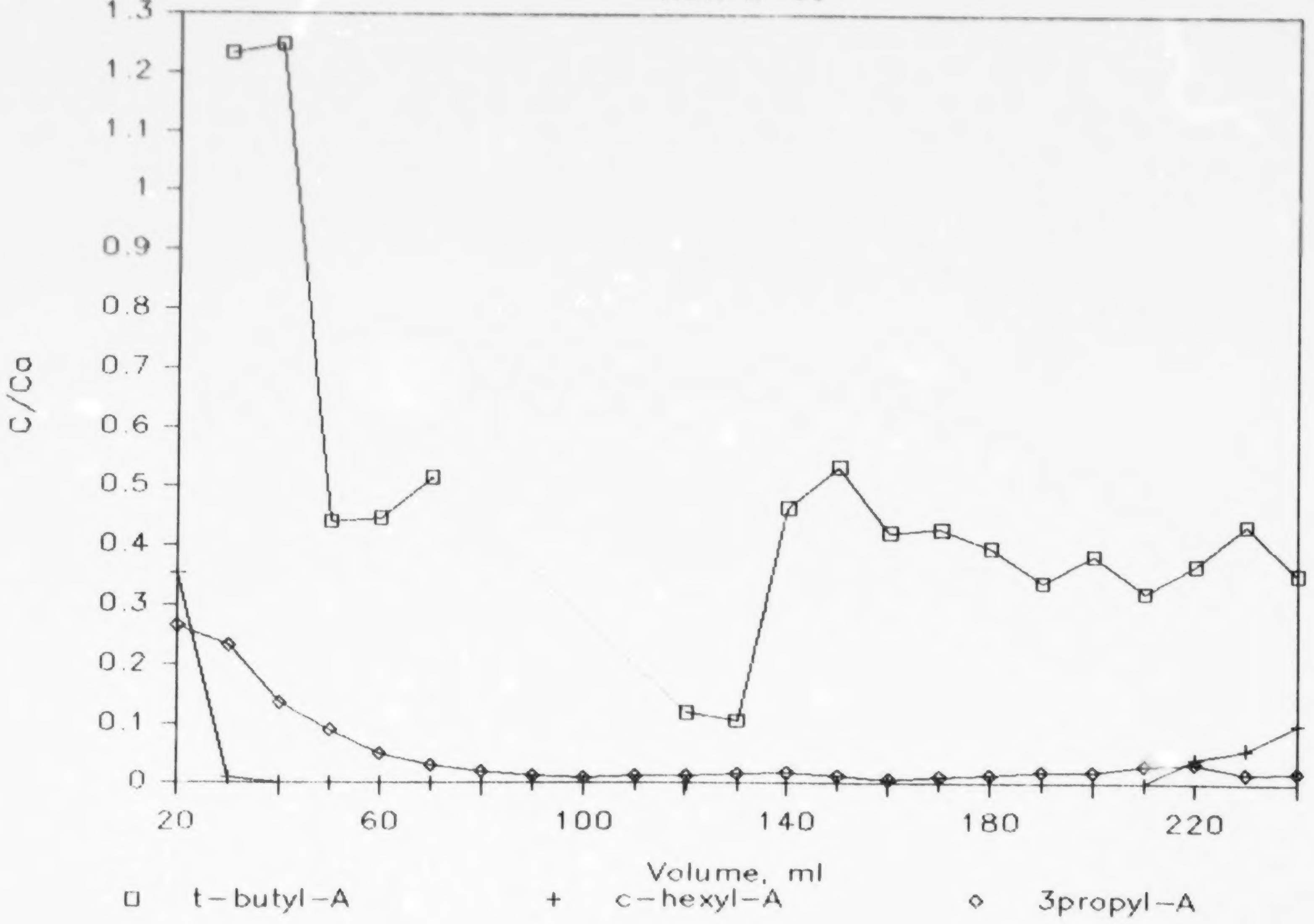
N–COMPOUNDS DESORPTION CURVES

RUN R–68



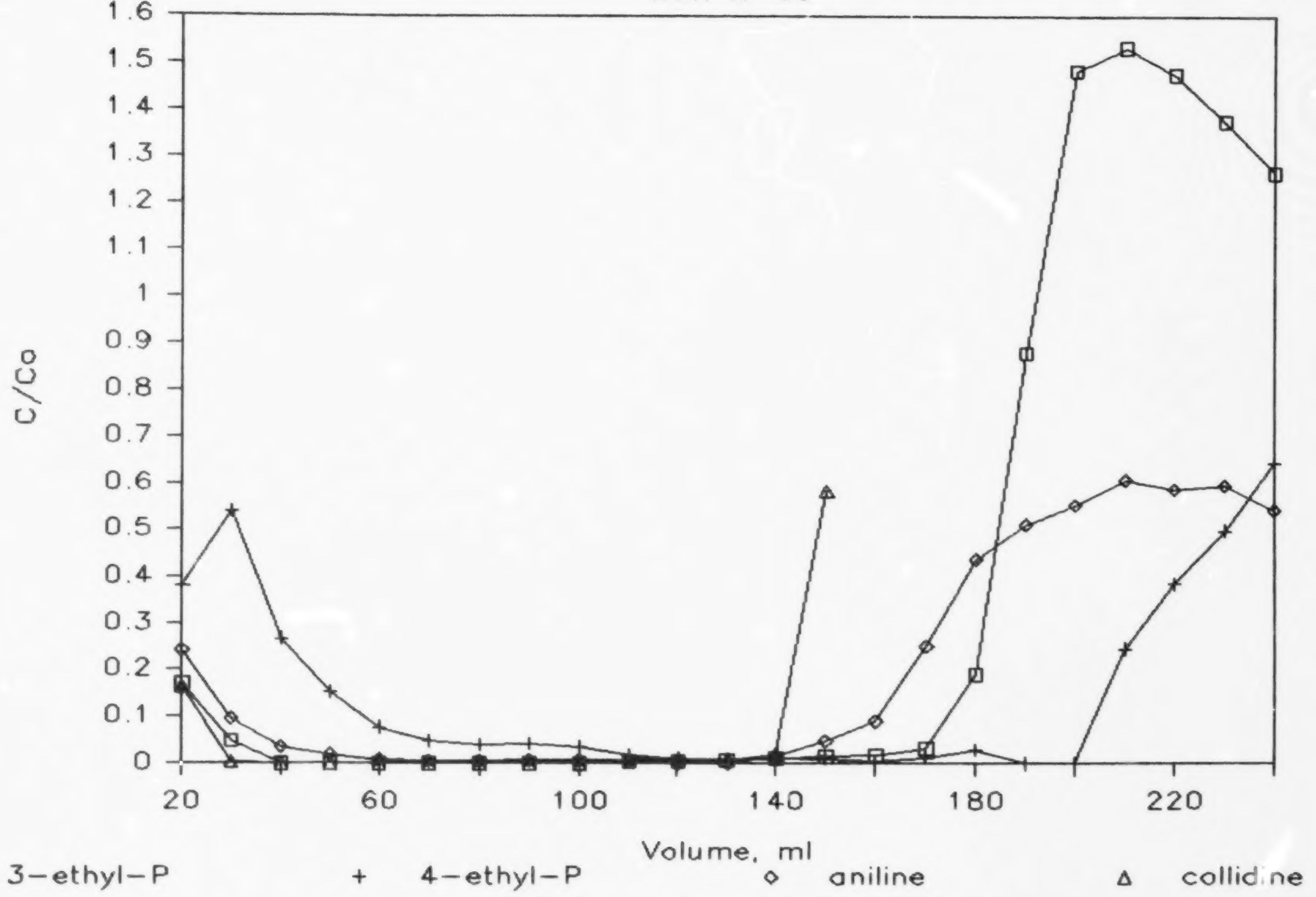
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-69



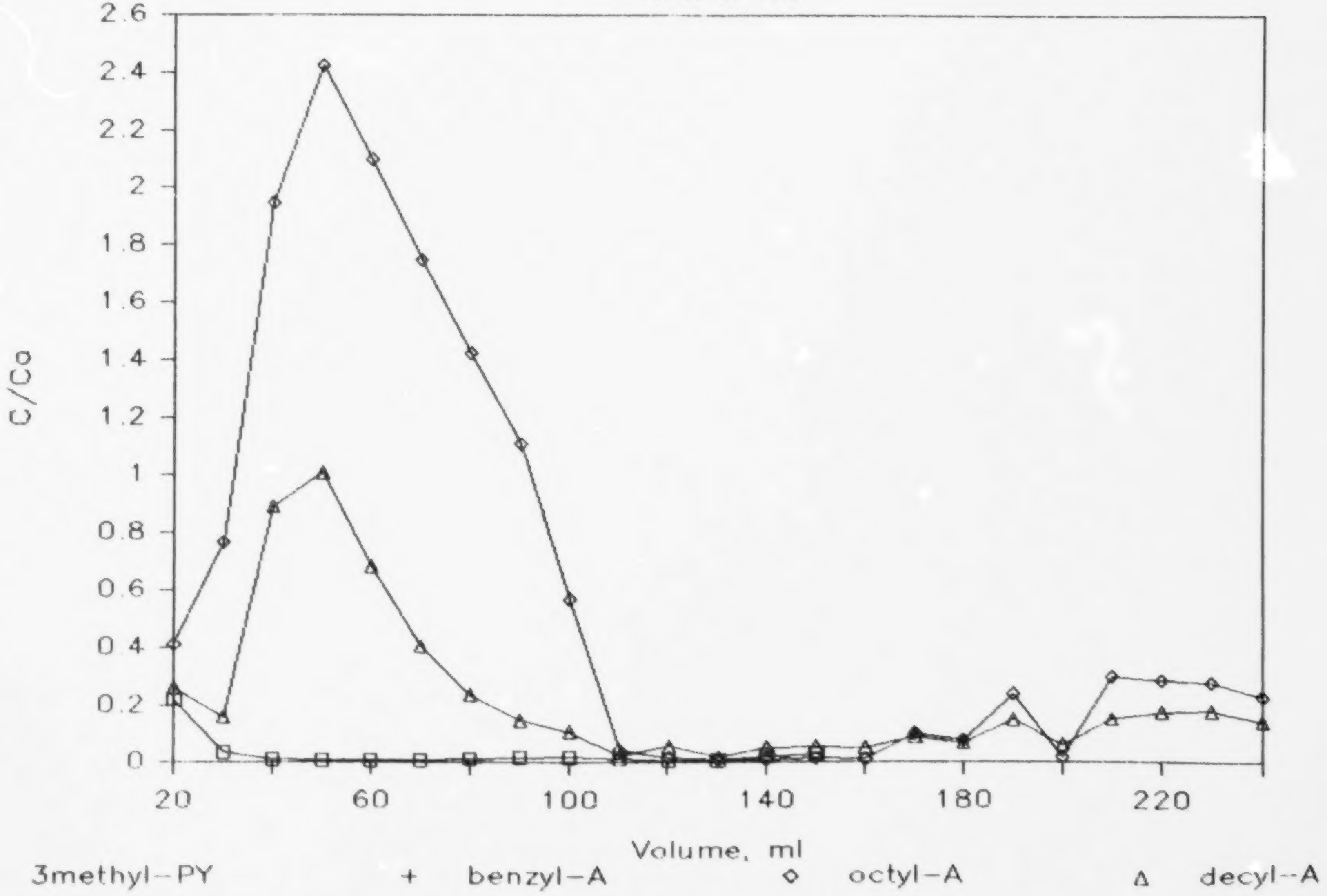
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-69



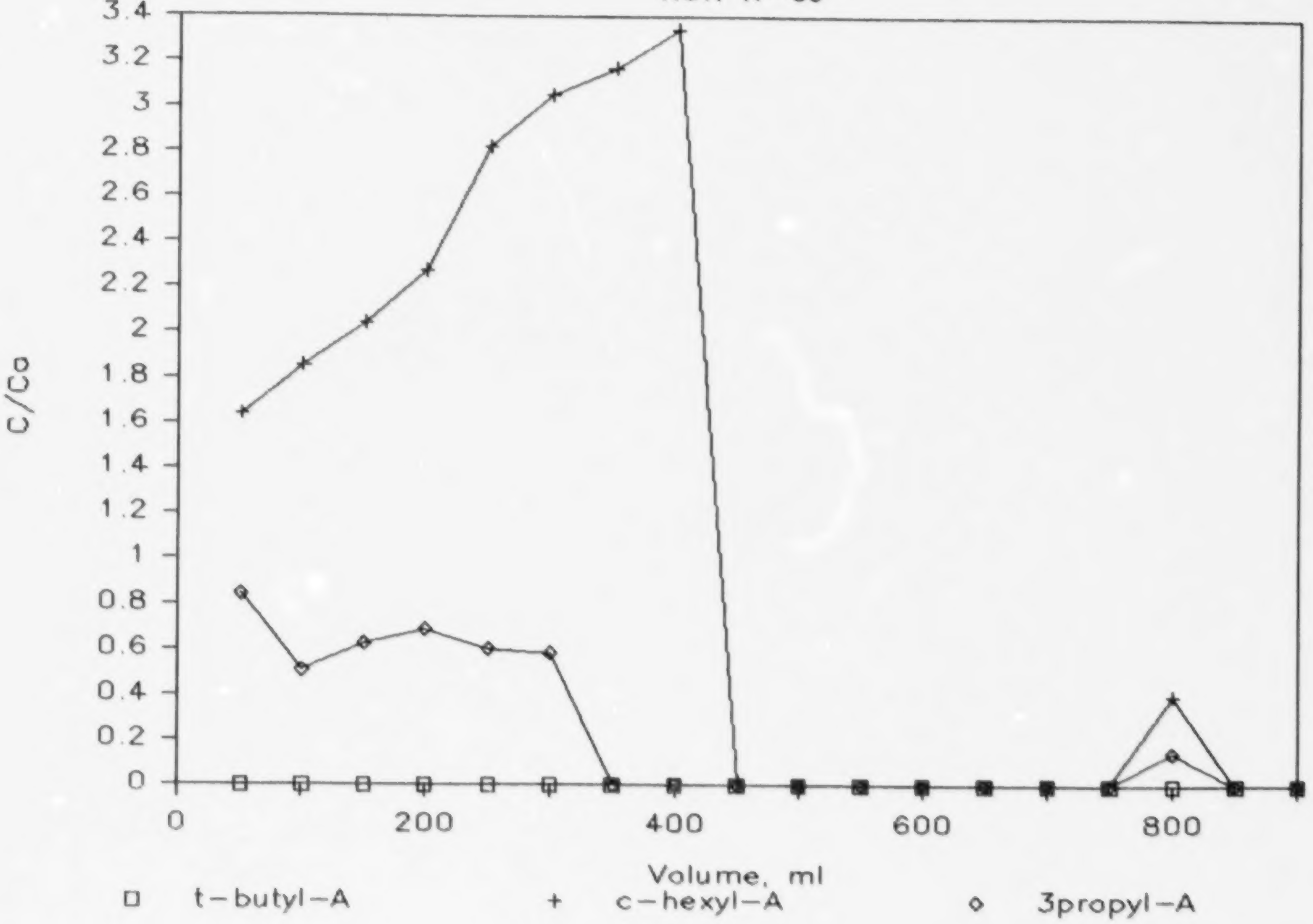
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–69



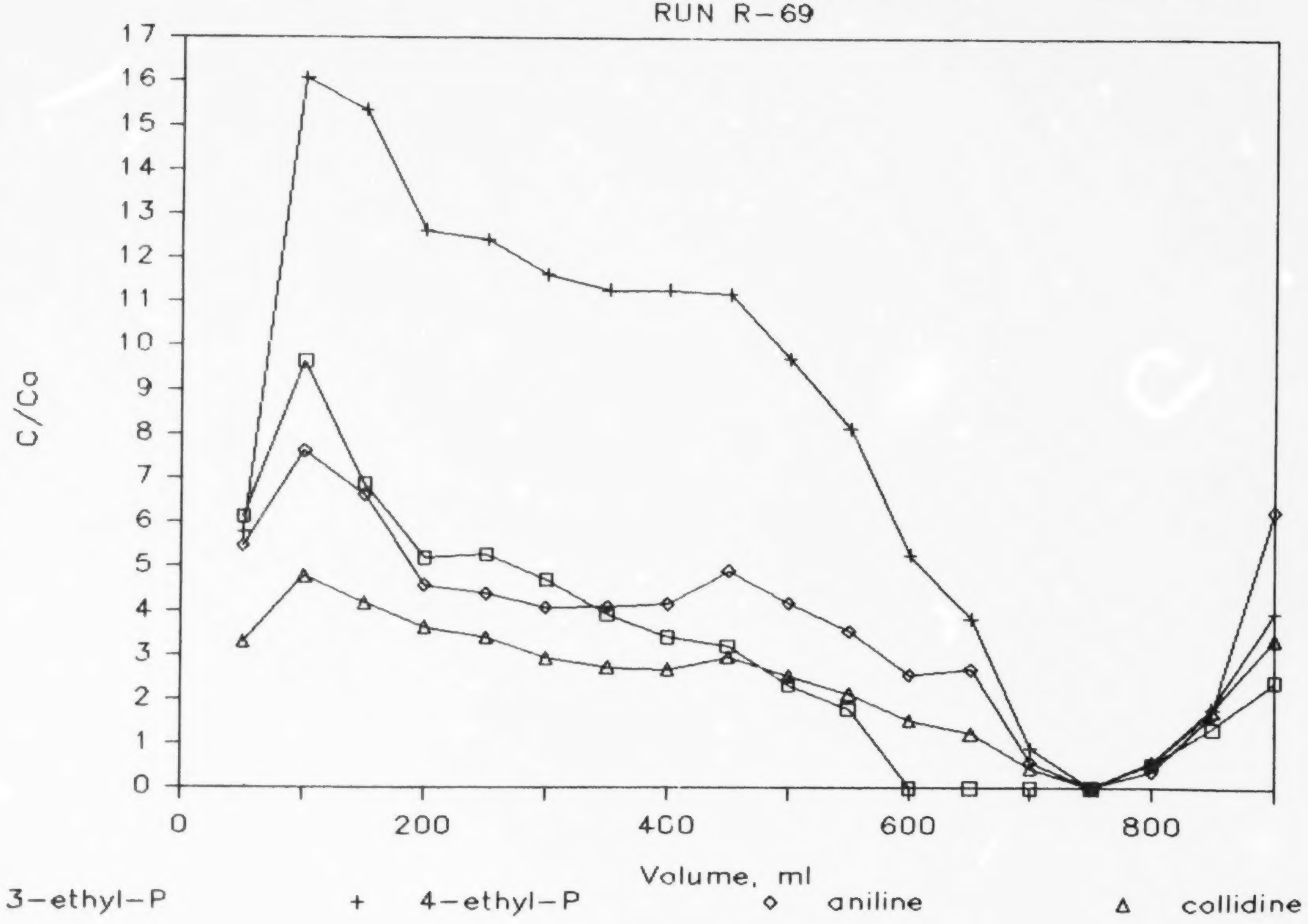
N-COMPOUNDS DESORPTION CURVES

RUN R-69



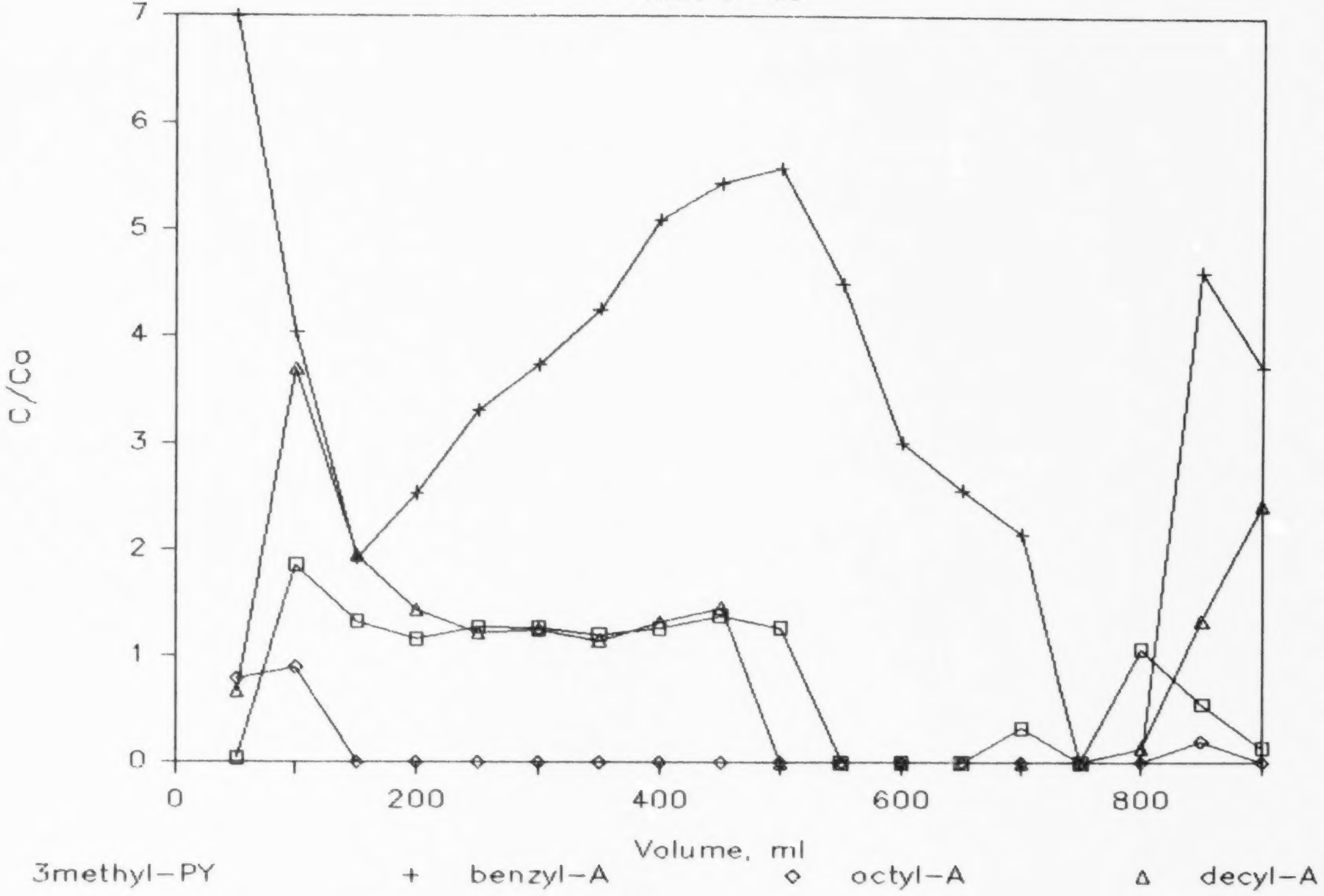
N-COMPOUNDS DESORPTION CURVES

RUN R-69



N-COMPOUNDS DESORPTION CURVES

RUN R-69



Run N-64: 13X, 2 ml/min, 15 psi, 65 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	20	0	0	0	0	0	0	0	0	0	0	0
2	40	0.043768	0	0.507256	0.023197	0.031418	0.010382	0.139544	0.218156	0.008647	0.157986	0.21355
3	60	0.013774	0	0.170121	0.005962	0.006921	0.003233	0.034079	0.127325	0.00225	0.054966	0.198006
4	80	0.028138	0	0.339716	0	0	0	0.011259	0.151074	0.005121	0.073387	0.330313
5	100	0.080491	0	0.66409	0	0	0	0.013125	0.217978	0.008662	0.181081	0.510274
6	120	0.129634	0	0.874248	0	0	0	0.014386	0.300179	0.010263	0.311566	0.574786
7	140	0.167098	0	1.048852	0	0	0	0.027582	0.527074	0.011253	0.584316	0.458937
8	160	0.190335	0	1.092417	0	0	0	0.074822	0.797003	0.011222	0.793443	0.387921
9	180	0.179786	0.023945	1.115355	0.010699	0.011791	0.010009	0.243085	1.125494	0.017933	1.017995	0.334487
10	200	0.270116	0.226878	1.012922	0.072052	0.065908	0.013824	0.599706	1.256871	0.014222	1.014629	0.2295
11	220	0.287671	0.670592	1.027781	0.282551	0.250999	0.051981	1.029077	1.324079	0.019311	1.10954	0.491653
12	240	1.227593	1.031259	0.974598	0.540486	0.484043	0.131072	1.069343	1.165506	0.024862	0.973923	0.598679
13	260	0.561296	1.078824	0.959001	0.715358	0.643799	0.264469	1.020762	1.071463	0.038117	0.922134	0.694409
14	280	0.574847	1.141492	0.970414	0.825914	0.749689	0.35126	1.027468	1.114772	0.050307	0.928275	0.779662
15	300	0.644023	1.190431	0.99088	0.918762	0.844936	0.456955	1.055762	1.108711	0.073047	0.962684	0.815128
16	320	1.023081	1.257313	0.964093	0.943992	0.872194	0.483669	1.064568	1.034129	0.097019	0.972686	0.79411
17	340	0.574877	1.273711	1.022741	1.019884	0.952495	0.585464	1.13137	1.091674	0.099191	0.953051	0.86332
18	360	0.896793	1.267578	1.015205	1.040793	0.978113	0.650177	1.116214	1.106827	0.11704	0.954615	0.895639
19	DEP	1.449205	1.188952	0.98061	0.997963	0.953278	0.668011	1.05693	1.107051	0.15849	1.019737	0.920396

Run R-64: 13X, 5 ml/min, Atmospheric pressure, 65 C, Toluene as regeneration solvent

						C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	1.481572	1.22574	1.04219	0.857945	0.789892	0.644199	1.20849	1.26991	0.160324	1.14668	0.841295
2	100	0.729524	1.207472	1.03632	0.949066	0.90587	0.764382	1.127543	1.141272	0.306589	1.085036	0.919984
3	150	0.846257	0.963829	0.773021	0.836717	0.819172	0.75401	0.809632	0.862384	0.298607	0.82227	0.771978
4	200	0.408834	0.31376	0.148024	0.296383	0.288218	0.316217	0.13295	0.217389	0.108608	0.22611	0.251219
5	250	0.067151	0.136099	0.038017	0.137752	0.135407	0.167007	0.111564	0.096724	0.051779	0.090343	0.105079
6	300	0.064185	0.087041	0.025287	0.096971	0.093984	0.123561	0.075349	0.058592	0.030199	0.045082	0.057553

Run N-65: 13X, 2 ml/min, 15 psi, 65 C, Standard solution 1000 ppm

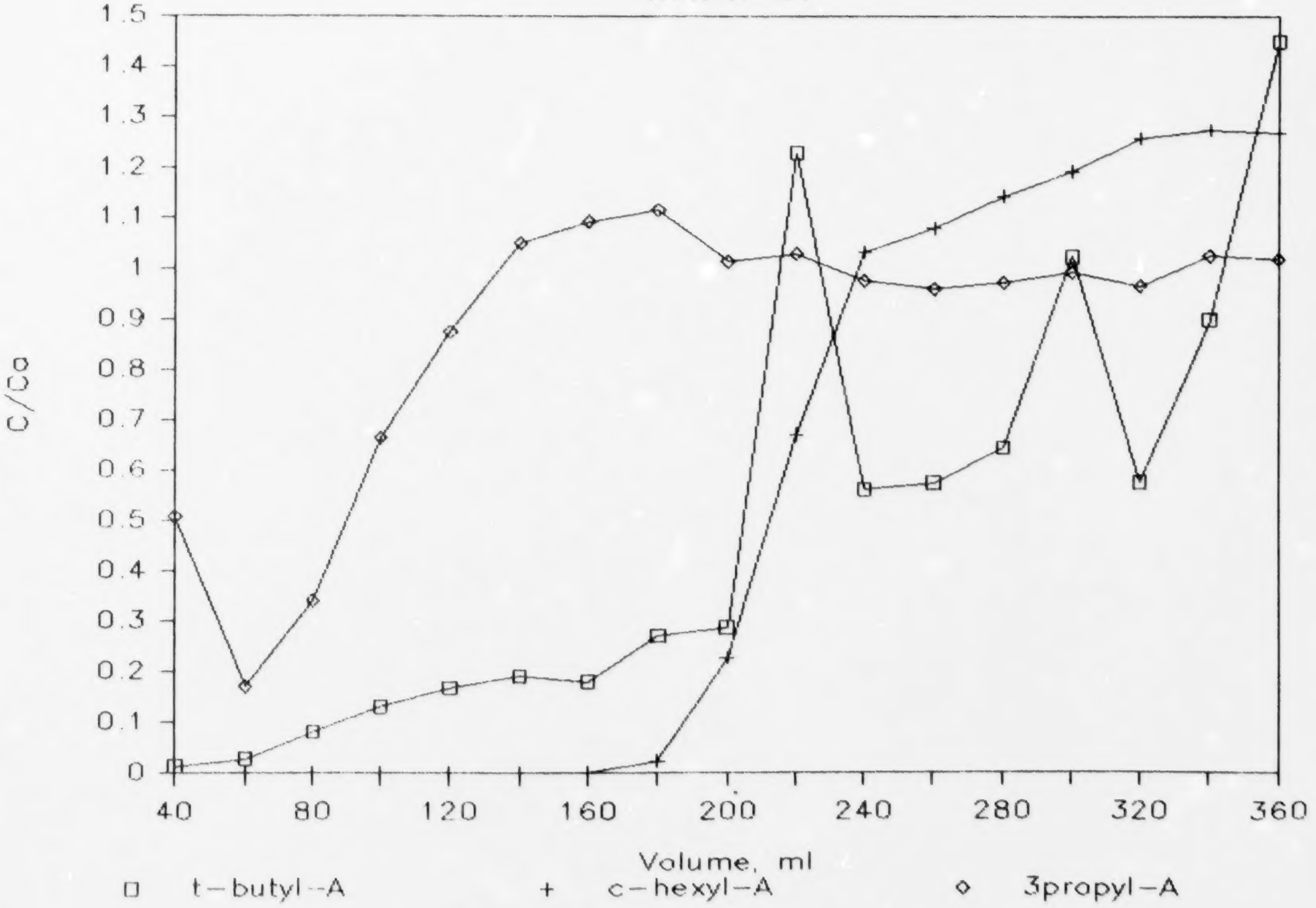
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	20	0	0	0	0	0	0	0	0	0	0	0
2	40	0	0.022469	0.049808	0.026307	0.009288	0.015472	0.177748	0.094627	0	0.067685	0.160727
3	60	0	0	0.010478	0	0	0	0.028711	0.030501	0	0.014216	0.042183
4	80	0	0	0.008212	0	0	0	0.016525	0.031509	0	0.008139	0.043843
5	100	0	0	0.021222	0	0	0	0.013939	0.037859	0	0.008624	0.059517
6	120	0	0	0.126566	0	0	0	0.016046	0.064461	0	0.019217	0.203964
7	140	0	0	0.348278	0	0	0	0.009175	0.085845	0.004716	0.02692	0.434305
8	160	0	0	0.771074	0	0	0	0.006671	0.174076	0.008599	0.064713	0.89522
9	180	0	0	1.013776	0	0	0	0.009129	0.3559	0.009722	0.160932	1.254416
10	200	0	0	1.149653	0	0	0	0.075793	0.734525	0.009717	0.473577	1.494247
11	220	0.040378	0.172571	1.127372	0.074799	0.070506	0.013901	0.49631	1.130683	0.010725	0.970104	1.457471
12	240	0.281029	0.669819	1.052814	0.354811	0.333436	0.079613	0.979255	1.199058	0.01376	1.1476	1.204575
13	260	0.686025	1.02746	1.026771	0.64964	0.602126	0.188592	0.911209	1.183348	0.019089	1.137957	1.061177
14	280	0.455219	1.177449	1.06922	0.85174	0.785509	0.303782	1.223387	1.208888	0.026687	1.151284	1.074482
15	300	0.619943	1.205858	1.089071	0.958676	0.890325	0.410537	1.247288	1.231714	0.035804	1.163749	1.129324
16	320	0.597983	1.205228	1.098502	1.10723	0.890543	0.505196	1.243044	1.242751	0.04905	1.160991	1.14176
17	340	0.799226	1.188303	1.081718	1.038228	0.979871	0.579176	1.231007	1.206446	0.079262	1.171871	1.138915
18	360	0.426751	1.193131	1.084137	1.054754	0.998813	0.633937	1.232232	1.175411	0.091926	1.152449	1.106109
19	DEP	1.024287	0.993255	0.954176	0.913481	0.893479	0.635684	1.047963	1.090359	0.09991	1.045144	1.058076

Run R-65: 13X, 5 ml/min, Atmospheric pressure, Ambient temperature, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.417356	1.086497	1.072215	1.005756	0.987486	0.747333	1.170863	1.163728	0.1651	1.058035	1.004814
2	100	0.44039	1.040549	1.066221	1.046099	1.071993	0.969288	1.115188	1.108075	0.526667	1.083942	1.099246
3	150	0.17159	0.286287	0.297029	0.323314	0.34901	0.380777	0.304347	0.330712	0.234403	0.306943	0.359852
4	200	0.050776	0.028921	0.022397	0.048896	0.051811	0.079342	0.031405	0.03	0.033984	0.043544	0.071207
5	250	0.021153	0	0.011008	0.029664	0.031206	0.052345	0.017381	0.017437	0.017727	0.022673	0.040526
6	300	0.009904	0	0.008588	0.023411	0.024829	0.041878	0.014024	0.014773	0.012588	0.018493	0.031416

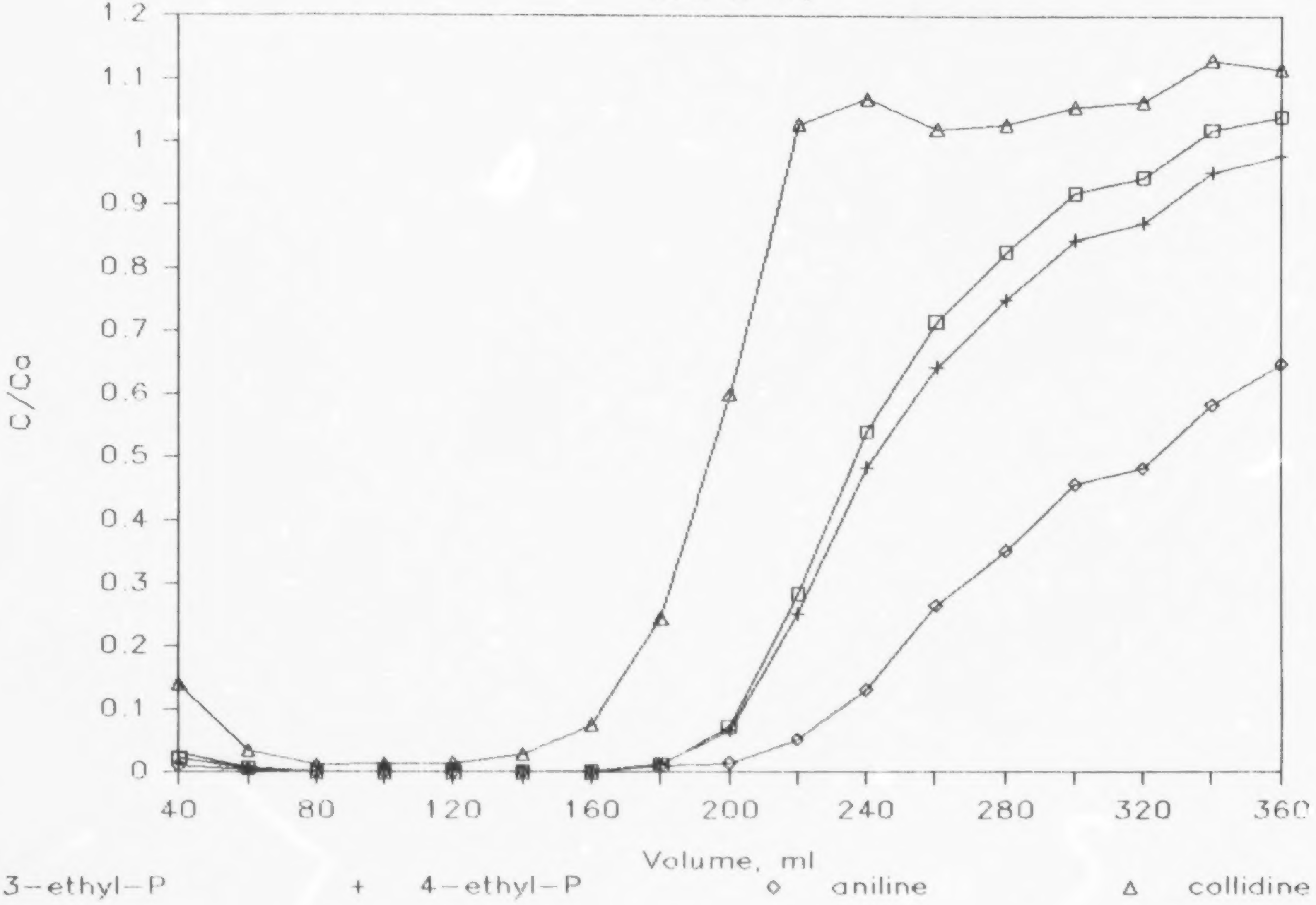
N—COMPOUNDS BREAKTHROUGH CURVES

RUN N-64



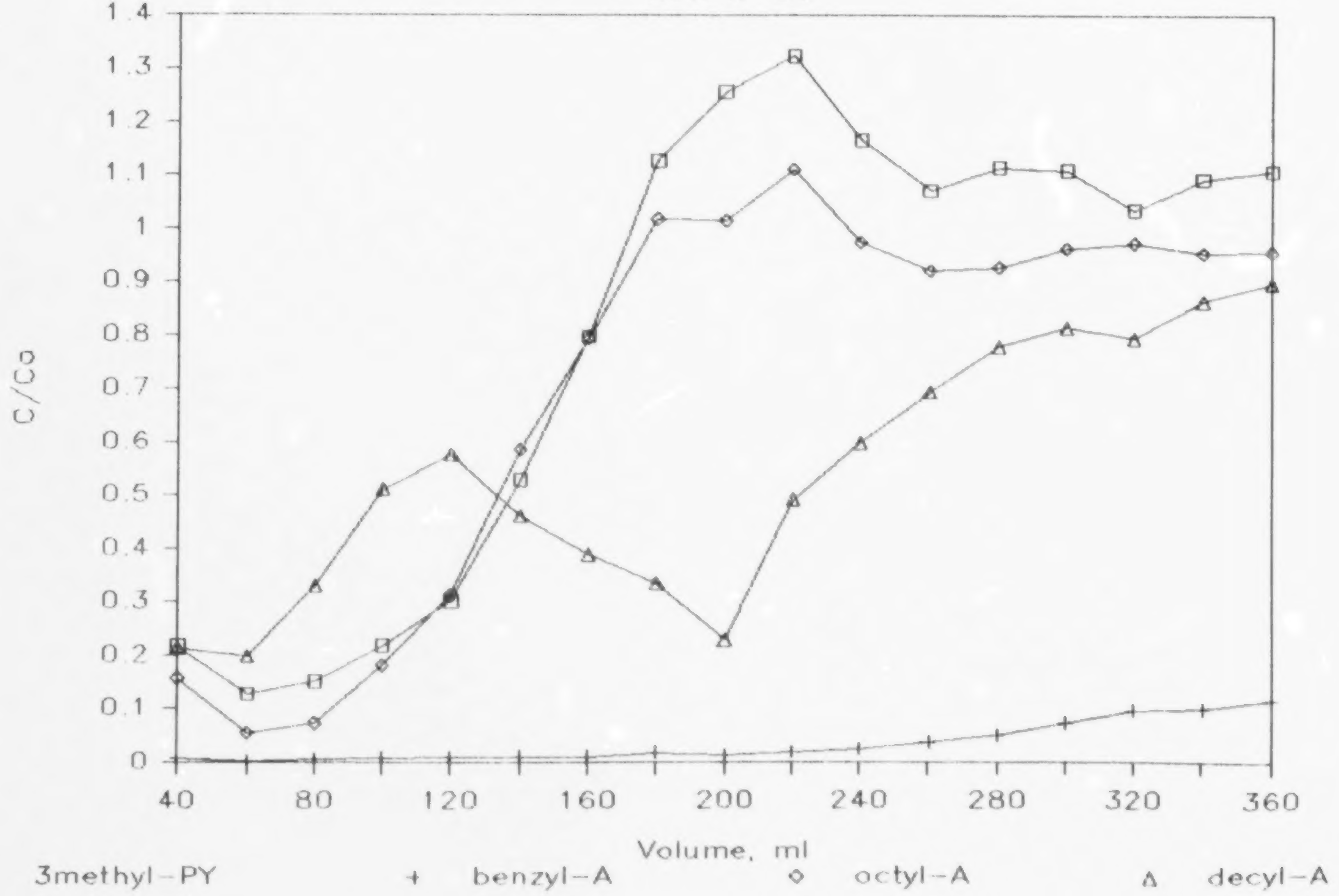
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-64



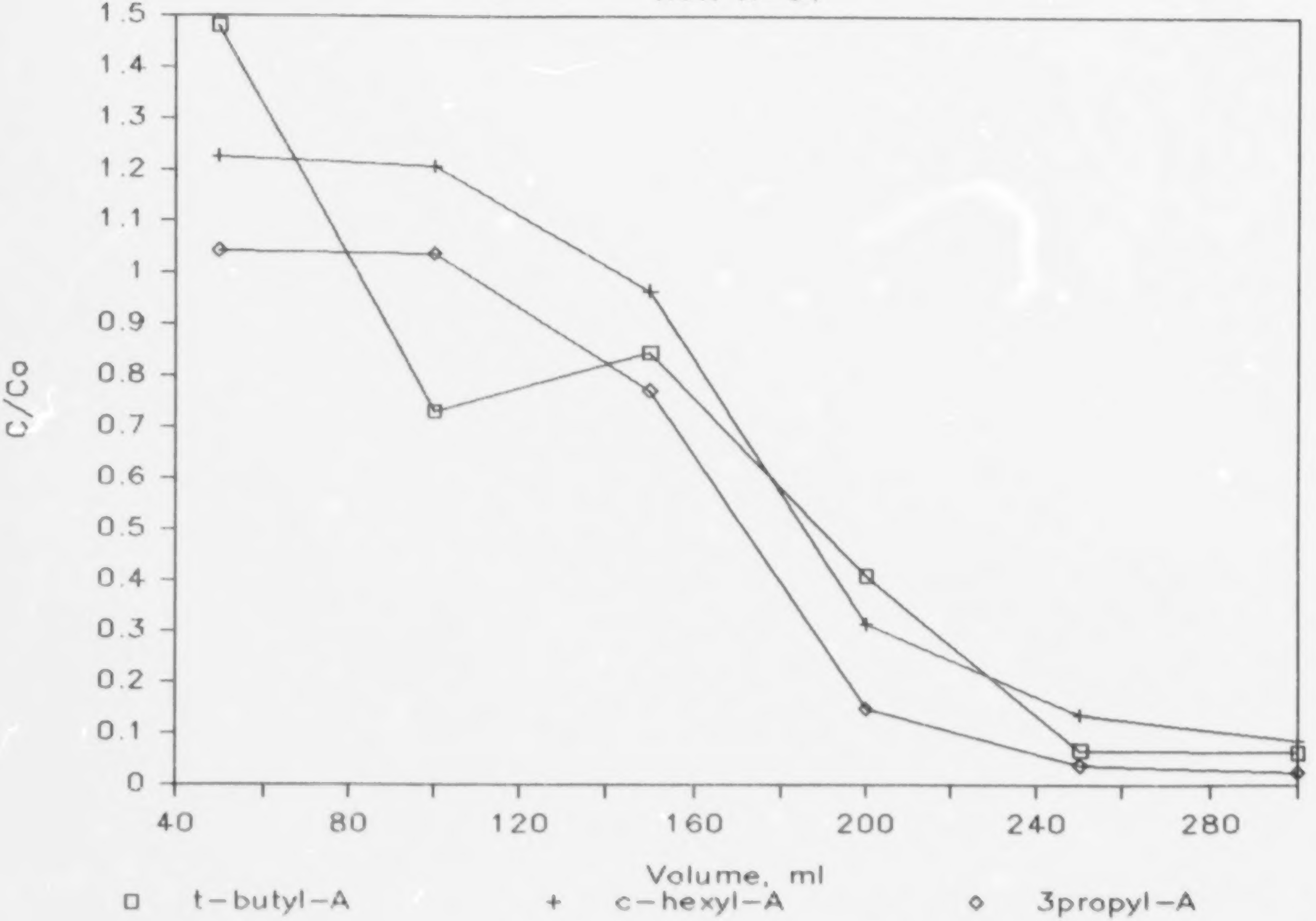
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-64



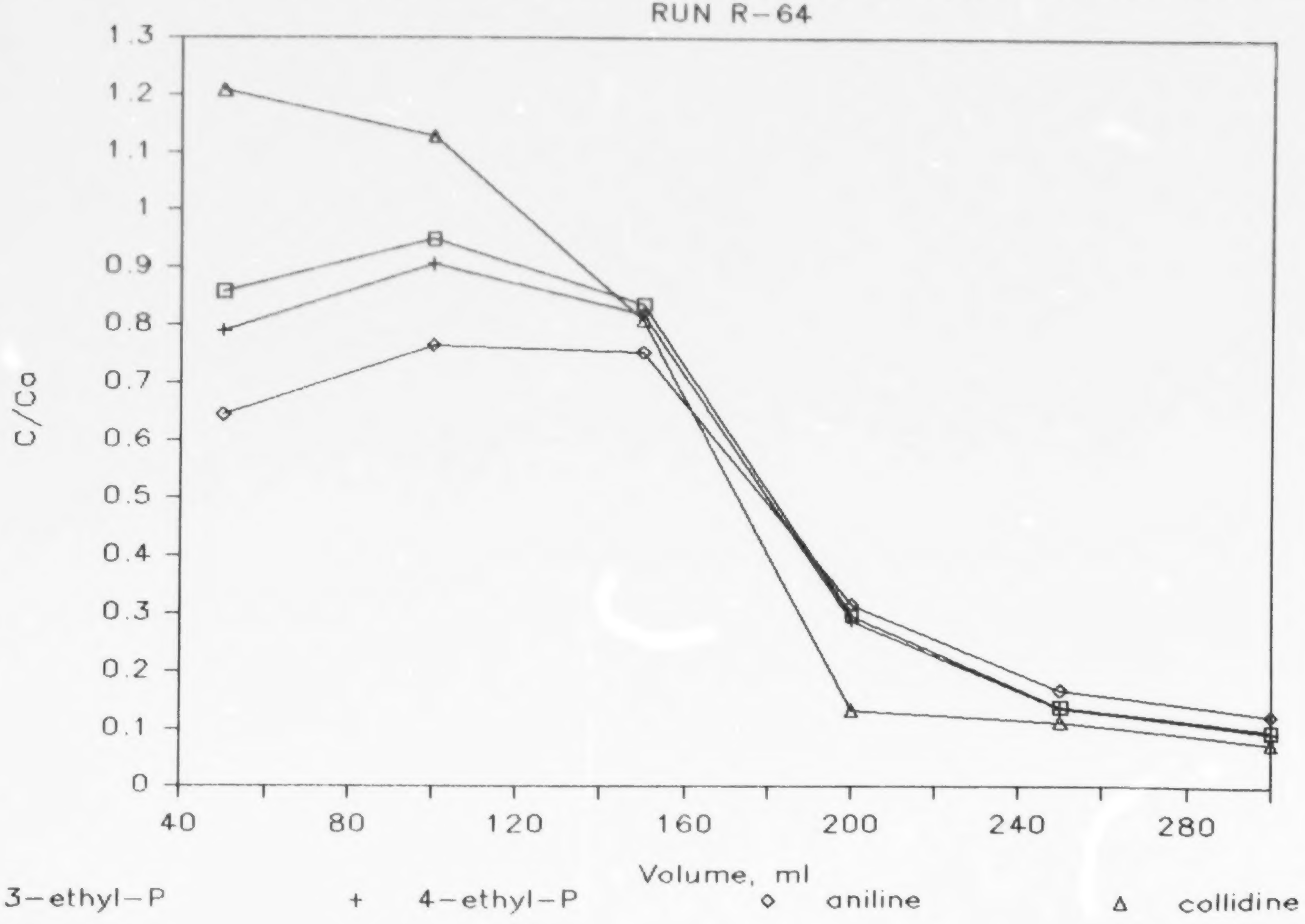
N-COMPOUNDS DESORPTION CURVES

RUN R-64



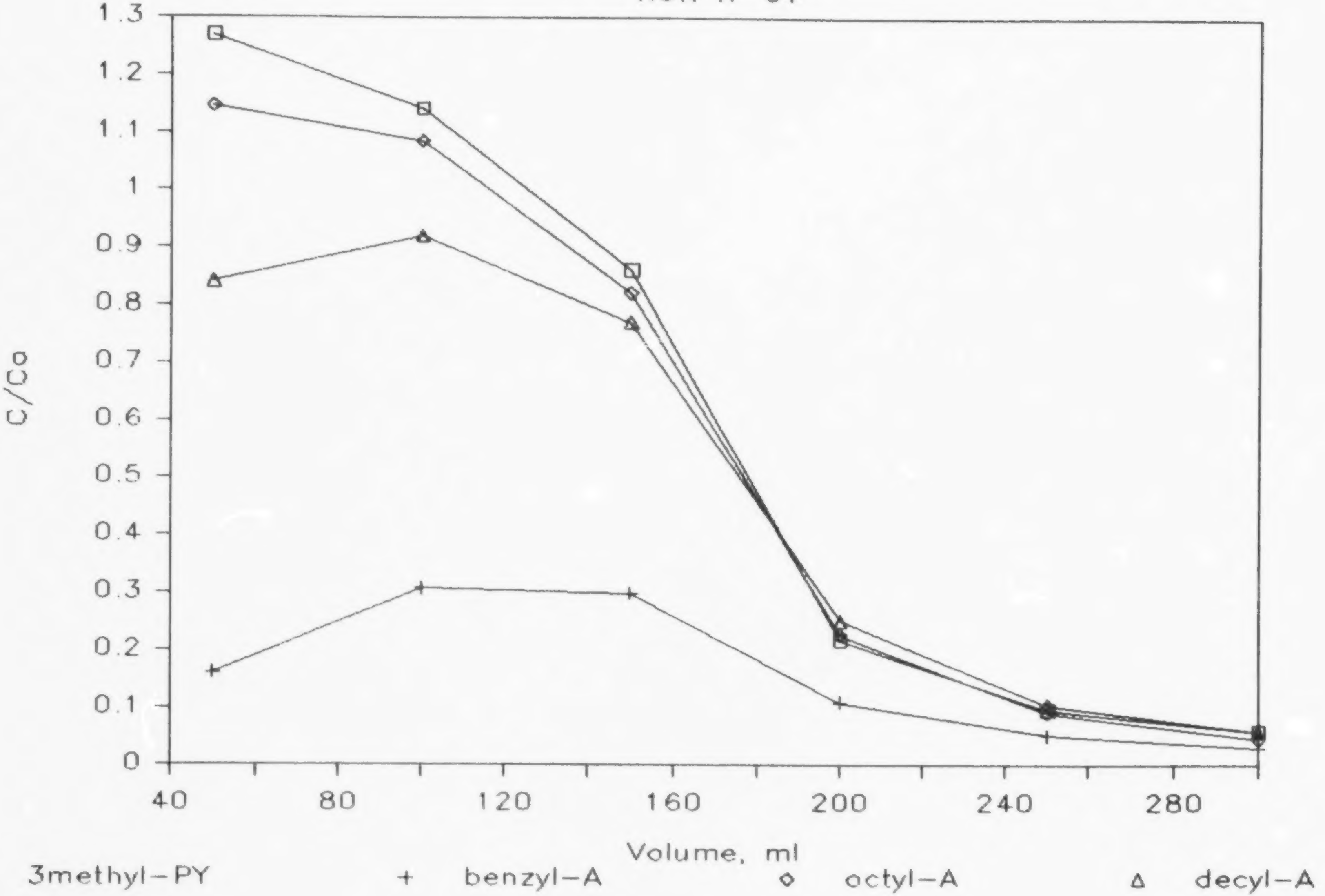
N–COMPOUNDS DESORPTION CURVES

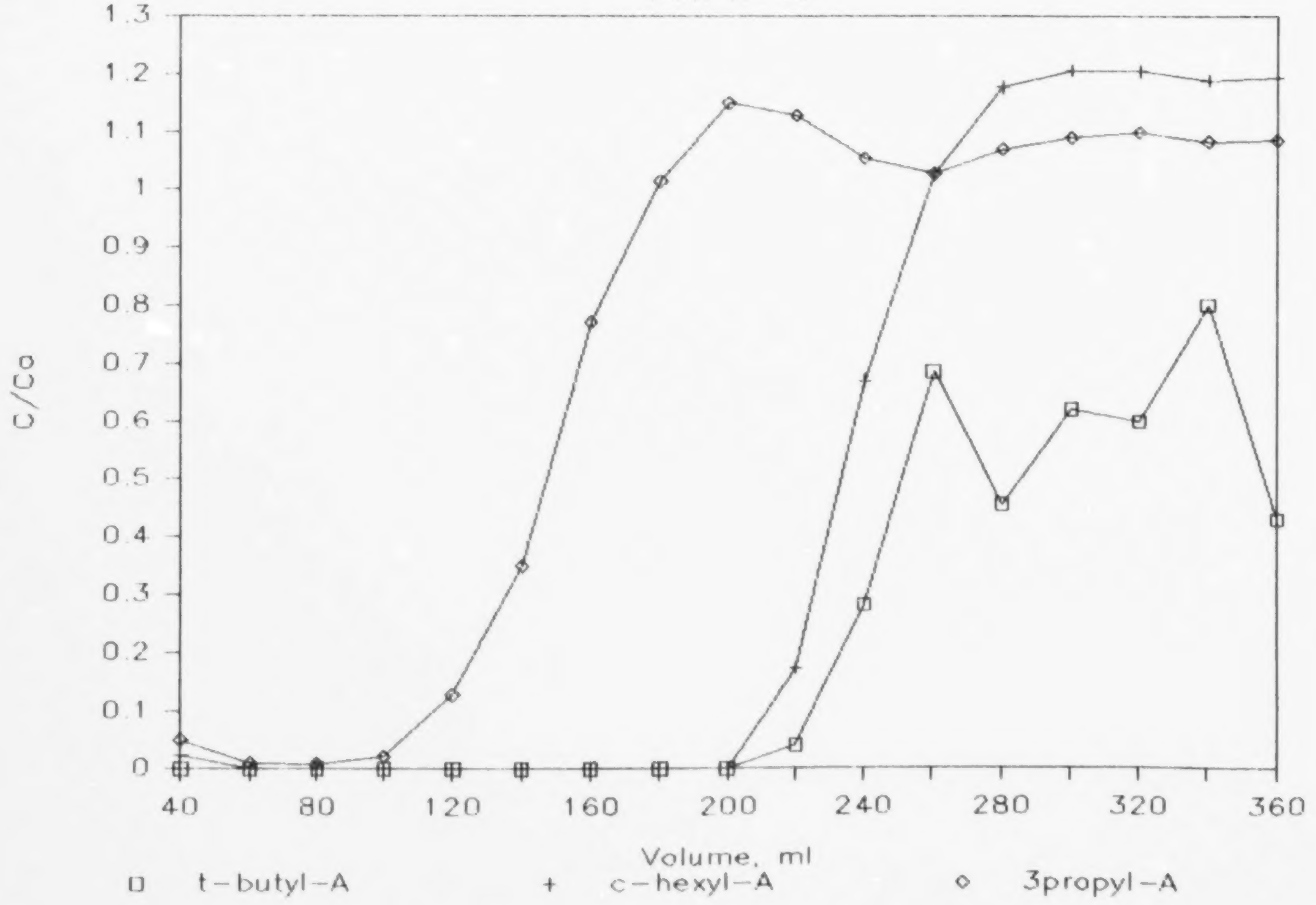
RUN R–64



N-COMPOUNDS DESORPTION CURVES

RUN R-64



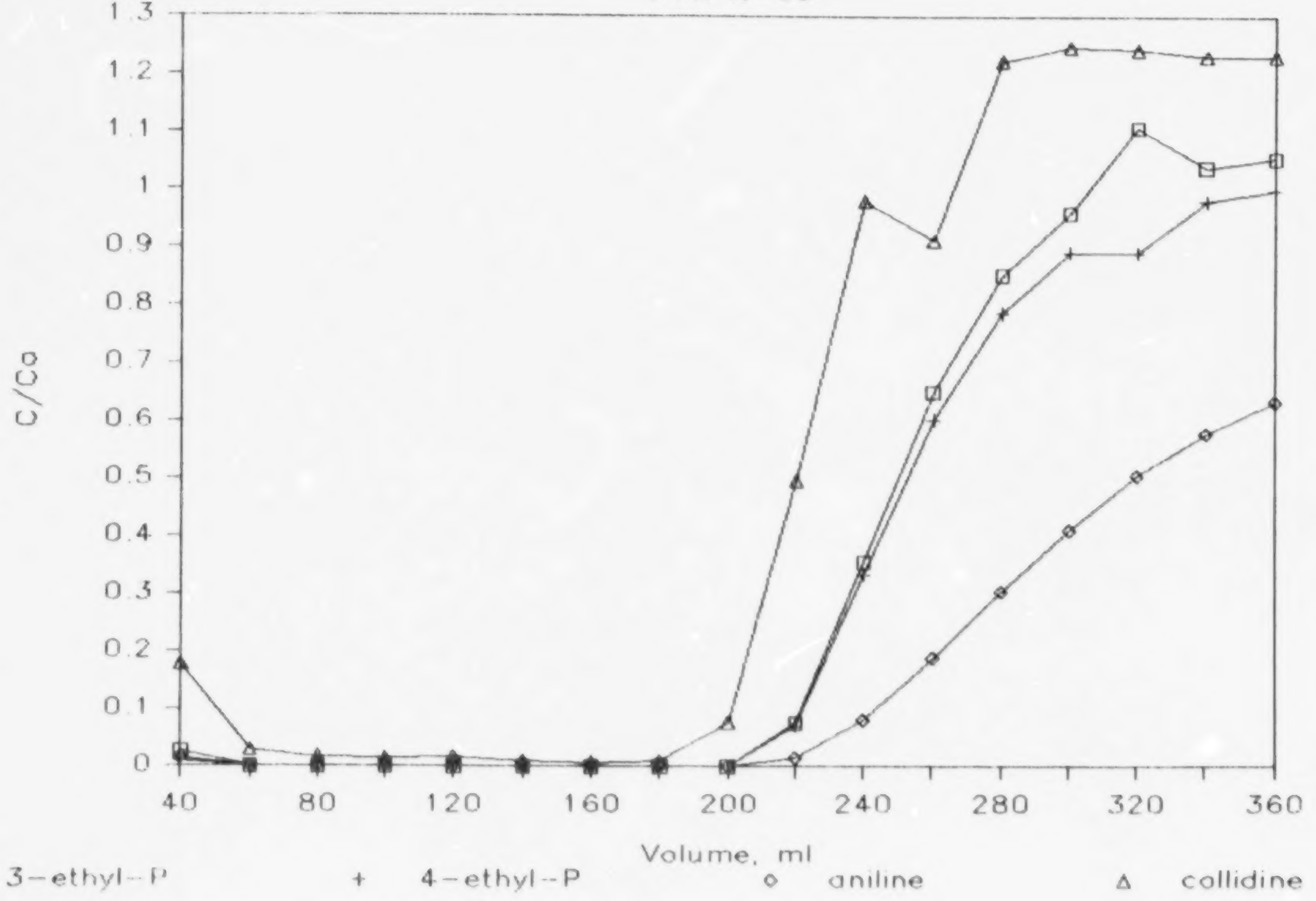


N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-65

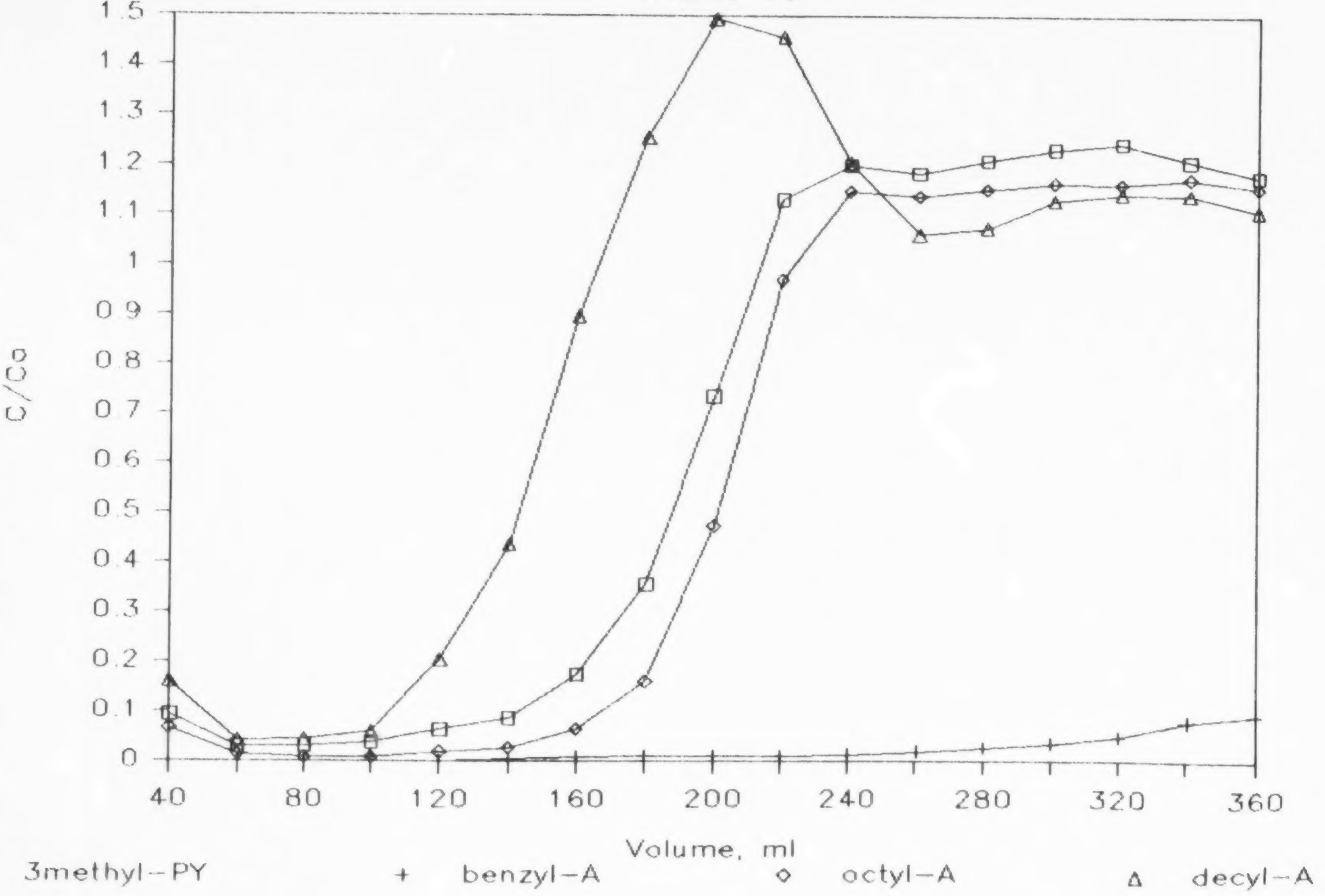
N--COMPOUNDS BREAKTHROUGH CURVES

RUN N-65



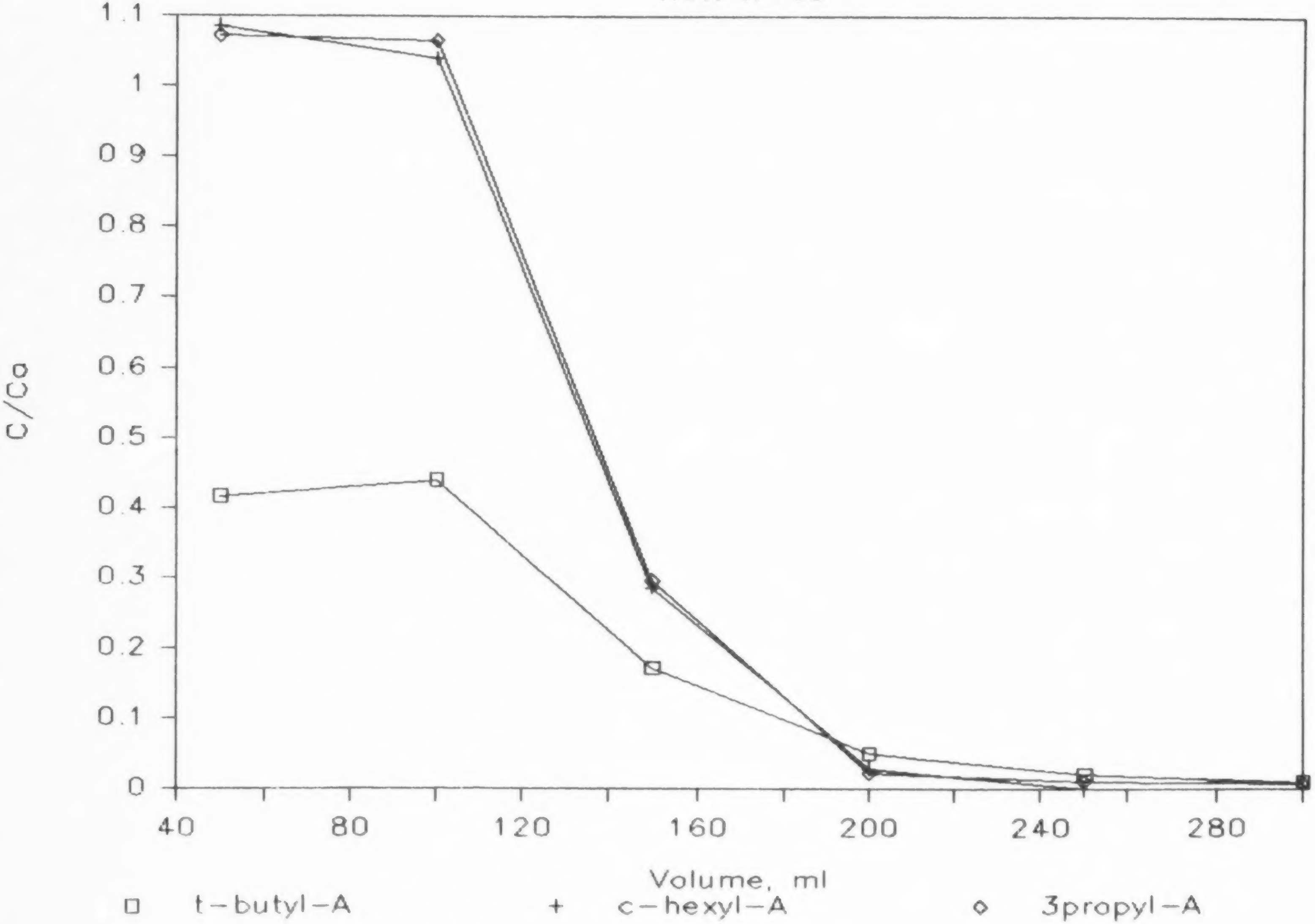
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–65



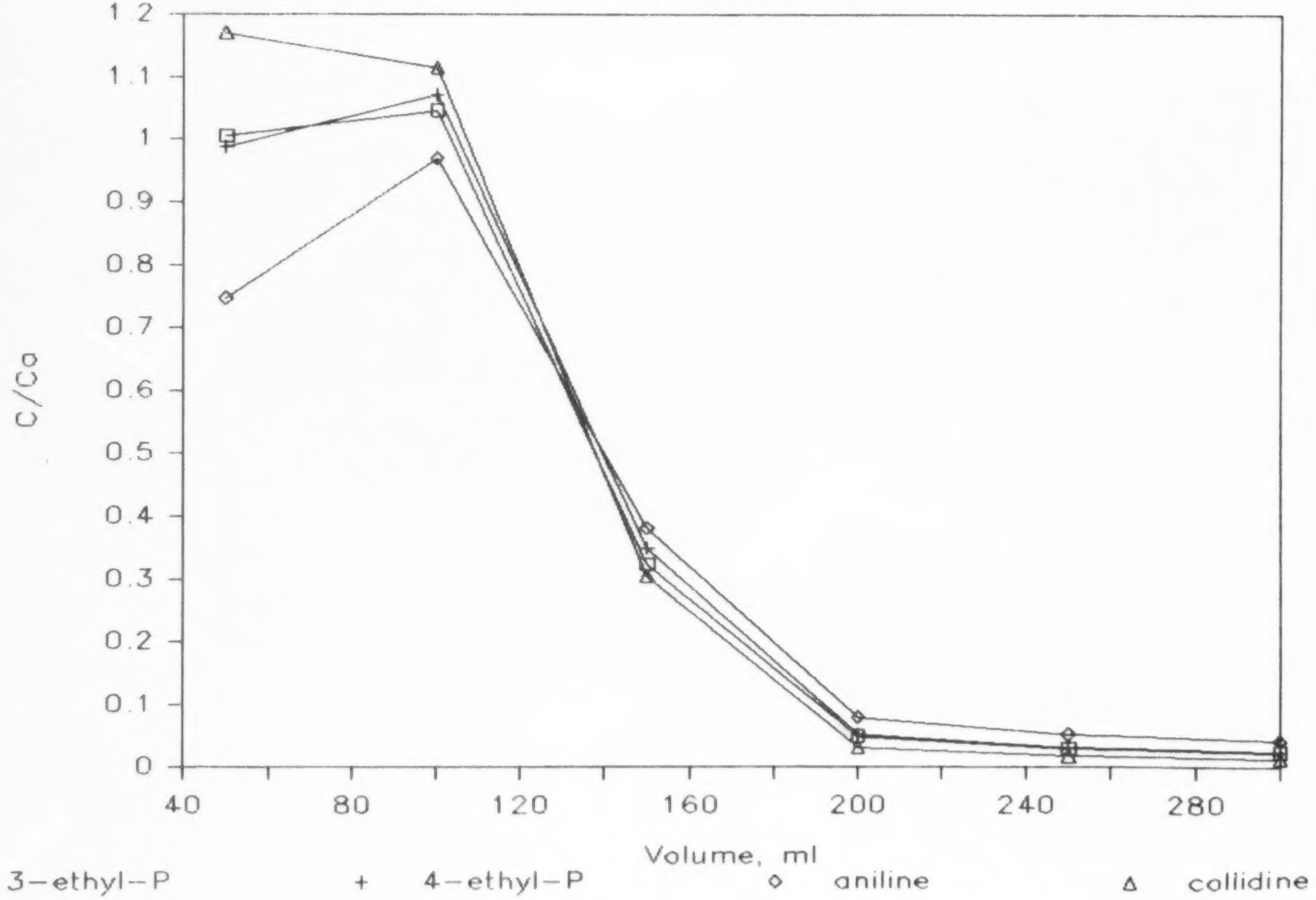
N-COMPOUNDS DESORPTION CURVES

RUN R-65



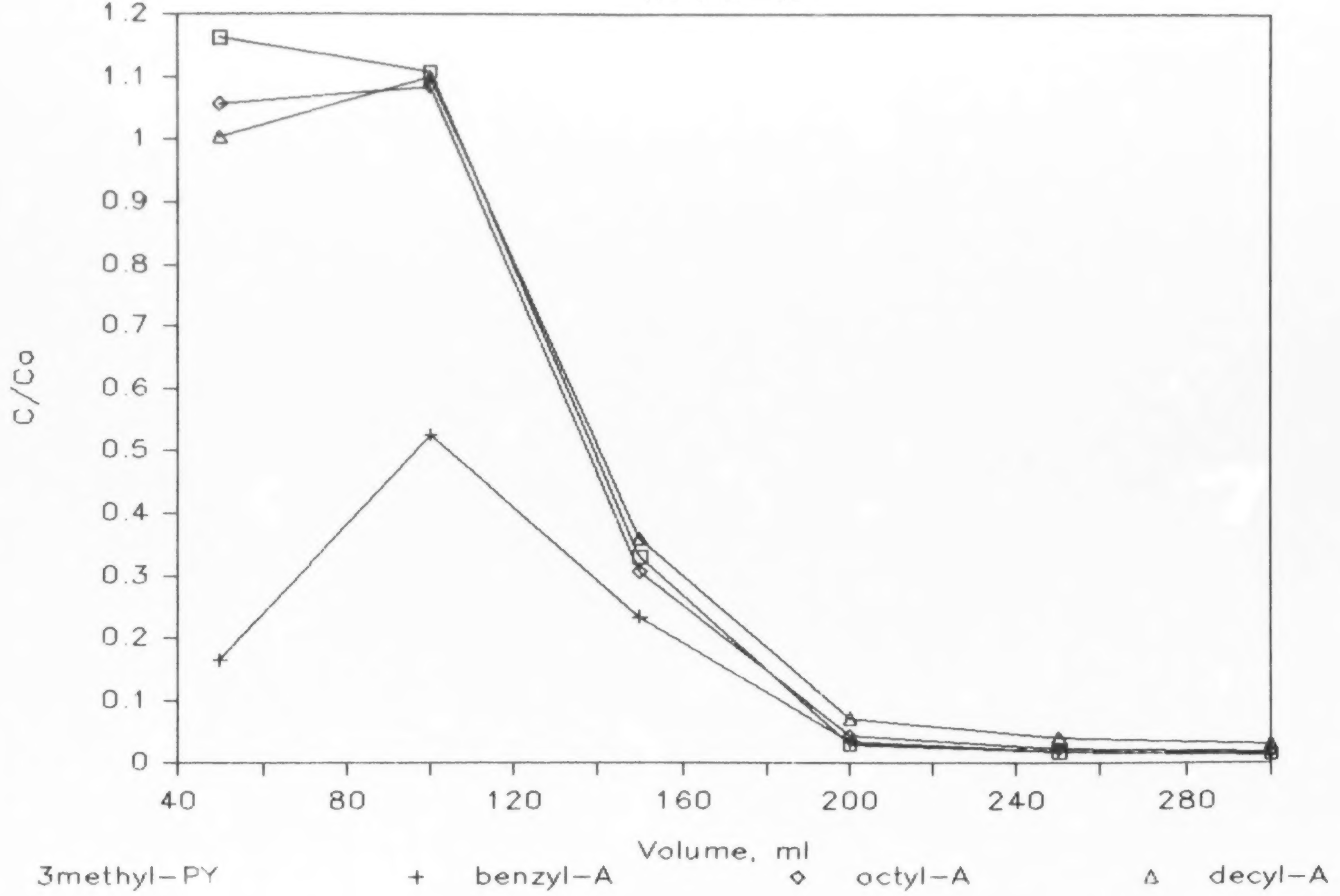
N-COMPOUNDS DESORPTION CURVES

RUN R-65



N-COMPOUNDS DESORPTION CURVES

RUN R-65



Run N-77: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0.0146863	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0.009449	0	0	0	0	0	0	0	0	0	0.0227587
5	50	0	0	0	0	0	0	0	0	0	0	0.0281554
6	60	0	0	0	0	0	0	0	0	0	0	0
7	70	0	0	0	0	0	0	0	0	0	0	0.011905
8	80	0	0	0	0	0.0079638	0	0	0	0.0211179	0	0.0205723
9	90	0.0110879	0	0	0	0	0	0	0	0.0344948	0.0104688	0.023411
10	100	0.0145298	0	0	0	0.0156773	0	0	0	0.1464471	0.0300622	0.0226142
11	110	0.0268539	0	0	0	0.0107011	0	0	0.0036041	0	0.0142515	0.0264008
12	120	0.0211439	0	0	0	0.0083957	0	0	0	0.0300626	0.0125841	0.0178215
13	130	0.017824	0	0	0	0	0.0629202	0	0.007546	0.0056295	0	0.0158439
14	140	0.013295	0	0	0.0105386	0	0.0638361	0.0575745	0.01832924	0.0131005	0	0.0220136
15	150	0.0207835	0	0	0.0080338	0	0.075027	1.0644039	0.00678291	0.0205362	0	0.0725725
16	160	0.2044927	0	0	0.0158035	0	0.1662396	0	2.4858993	0	0	0.1243328
17	170	0.4312805	0	0	0.0180445	0	0.0556986	0	2.3598694	0	0	0.1121491
18	180	0.3116085	0	0.0036385	0.1634953	0	0.0735334	0	0.2039283	0	0	0.1701128
19	190	0.3579051	0	0	0	0.9412037	0.600492	0	1.5684122	0	0	0.0930621
20	200	0.2916545	0	0	0	1.4207878	0.1015984	0	1.437322	0.0351184	0	0.0950399
21	210	0.2195756	0	0.0071267	0	1.5588115	0.0756848	0	1.4270142	0	0	0.0910875
22	220	0.1855472	0	0.0060899	0	1.3433614	0.5893548	0	1.4446757	0	0	0.856733
23	230	0.360064	0	0.0151852	0	1.5737002	0.7890473	0	1.8068945	0	0	0.1250756
24	240	0.2492469	0	0.0139947	0	0.9980979	0.5331358	0	1.2026374	0	0.0254791	0.1171127
25	DEP	0.4442537	0	0.0193226	0	1.1865085	0.6286577	0	1.5965005	0	0	0.057765

Run R-77: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 70 C, Toluene as regeneration solvent

						C/Co					
# ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1 50	0.1610482	0	0.2322169	0.4469414	0.4007917	0.3922419	0.3795708	0.2081999	0.1569829	0.1403832	0.1391387
2 100	0.0537509	0	0.0563373	0.218905	0.213459	0.2816377	0.1986686	0.1283785	0.1358779	0.1161166	0.2332207
3 150	0.0129051	0	0.0184111	0.072457	0.0941932	0.1061341	0.0600957	0.0346469	0.0355897	0	0.0482583
4 200	0	0	0.0268034	0.0576842	0.0672332	0.102823	0.0827345	0.0526181	0.0463501	0	0.0500247
5 250	0	0	0.0117032	0	0.034316	0.0408119	0.0441829	0	0	0.024817	0
6 300	0	0	0.0062515	0.0155002	0.0213947	0.046218	0.0582485	0	0	0	0
7 350	0	0	0.0055862	0.0107942	0.0176842	0.0212551	0.0208654	0	0	0	0
8 400	0	0	0	0.0096379	0.0155027	0.0159451	0.0153678	0	0	0	0
9 450	0	0	0	0	0	0.0120755	0.0109597	0	0	0	0
10 500	0	0	0	0	0	0.0107764	0.008529	0	0	0	0
11 550	0	0	0	0	0	0.0109443	0.0079896	0	0	0	0
12 600	0	0	0	0	0	0.0095343	0.0063527	0	0	0	0
13 650	0	0	0	0	0	0.0093794	0.0061235	0	0	0	0
14 700	0	0	0	0	0	0.0082518	0	0	0	0	0
15 750	0	0	0	0	0	0.0078597	0	0	0	0	0
16 800	0	0	0	0	0	0	0	0	0	0	0
17 850	0	0	0	0	0	0	0	0	0	0	0
18 900	0	0	0	0	0	0	0	0	0	0	0

Run N-78: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.0097954	0	0	0	0.0024262	0.002984	0	0	0.0030124	0	0
6	60	0	0	0	0	0.0712096	0.0087381	0	0	0.0870225	0.0064537	0
7	70	0	0	0.0047152	0	0.0737285	0.0085084	0	0	0	0.0123409	0
8	80	0	0	0.0050359	0	0.0020888	0.0069713	0	0	0	0.0181883	0
9	90	0	0	0.038621	0	0.0517676	0.0058117	0	0	0	0	0
10	100	0	0	0	0	0.0383928	0.0052082	0	0	0.1205813	0	0
11	110	0	0	0	0	0.0207294	0	0	0	0	0	0.0070033
13	130	0	0	0	0	0.0279873	0	0	0	0.0620014	0	0
14	140	0	0	0	0	0.0347756	0	0	0.0082194	0.0811224	0.0229598	0.009524
15	150	0	0	0	0.0077947	0	0	0	0.0104186	0.0386808	0.0153301	0.0204491
16	160	0.0135414	0	0	0.0125963	0.0090426	0	0.0082474	0.0100927	0.0198625	0	0.0172446
17	170	0.0428712	0	0	0.0156406	0.0074573	0	0.0200294	0.0140262	0.0125609	0	0.0090872
18	180	0.5990236	0	0	0.0144308	0.0093806	0	0.0789957	0.0209967	0.0176623	0	0.0158326
19	190	0.215092	0	0	0.0140605	0.00818141	0	0.4088307	0.0306929	0.0125505	0	0.0111675
20	200	0.7155833	0	0	0	0.0092681	0.168644	0	1.40256222	0.0133646	0	0.0151823
21	210	0.4168308	0	0	0.0077157	0	0.2517335	0	1.4033023	0.0056251	0	0.0118395
22	220	0.7908667	0	0	0.0558163	0	0.5077129	0	2.1111395	0.0090279	0	0.0142401
23	230	0.590573	0	0	0.6457508	0	0.7183035	0	1.9307909	0.0073897	0	0.0235818
24	240	0.6439251	0	0	0.9965267	0	0.677871	0	1.7740141	0.0128498	0	0.0197211

Run R-78: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 85 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.169403	0	0.1995676	0.2198601	0.2474722	0.2789039	0.2480988	0.2583433	0.1035422	0.1243433	0.0703494
2	100	0.0187189	0	0.0234068	0.106085	0.1299894	0.1945061	0.1430622	0.15319	0.1100221	0.113793	0.1351739
3	150	0	0	0.0125369	0.0600658	0.0701264	0.1275156	0.1027682	0.1059866	0.0598338	0.0503117	0.2280171
4	200	0	0	0	0.0176696	0.0380507	0.0490921	0.048129	0.0517636	0	0.0227225	0.0441502
5	250	0	0	0	0.0116943	0.0313016	0.0606803	0.0395845	0.0335258	0	0.0108587	0
6	300	0	0	0	0	0.003127	0.0259854	0.0314268	0	0	0	0
7	350	0	0	0	0	0	0.019546	0.0340068	0	0	0	0
8	400	0	0	0	0	0	0.0192186	0.0314349	0	0	0	0
9	450	0	0	0	0	0	0.0189694	0.0303594	0	0	0	0
10	500	0	0	0	0	0	0.0184234	0.027475	0	0	0	0
11	550	0	0	0	0	0	0.0189512	0.0269993	0	0	0	0
12	600	0	0	0	0	0	0.0183832	0.025246	0	0	0	0
13	650	0	0	0	0	0	0.0180255	0.0237745	0	0	0	0
14	700	0	0	0	0	0	0.01726	0.0221968	0	0	0	0
15	750	0	0	0	0	0	0.0167247	0.0209156	0	0	0	0
16	800	0	0	0	0	0	0.0159272	0.0194818	0	0	0	0
17	850	0	0	0	0	0	0.0154923	0.0185216	0	0	0	0
18	900	0	0	0	0	0	0.0147862	0.0172806	0	0	0	0

Run N-79: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, 15 psi, 75 C, Standard solution 200 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	0	0	0	0	0	0	0	0	0	0
2	100	0.09146	0	0	0	0	0	0	0	0	0	0
3	150	0.03662	0	0	0	0	0	0	0	0	0	0
4	200	0	0	0	0	0	0	0	0	0	0	0
5	250	0	0	0	0	0	0	0	0	0	0	0
6	300	0	0	0	0	0	0	0	0.1482	0	0	0
7	350	0	0	0.46488	0	0	0	0	0.82248	0	0	0
8	400	0	0	1.20118	0	0	0.04253	0.14162	1.22331	0	0	0
9	450	0	0	1.80123	0.0533	0	0.09256	0.36675	1.48625	0	0	0.33094
10	500	0	0	1.91588	0.1561	0.08819	0.17282	0.58386	1.68444	0	0.2645	0.73882
11	550	0	0	1.90234	0.28836	0.16735	0.26387	0.77668	1.75384	0	0.58199	1.31752
12	600	0.0978	0	1.8688	0.44544	0.26953	0.36595	0.95044	1.78383	0	0.84249	1.47388
13	650	0.26715	0.27226	1.79059	0.57489	0.35921	0.44544	1.05604	1.77431	0	0.93271	1.48066
14	700	0.42415	0.74225	1.72594	0.70001	0.45006	0.5352	1.14768	1.7759	0	1.09045	1.60727
15	750	0.61991	1.28648	1.69575	0.83041	0.54051	0.61772	1.24212	1.77124	0.04543	1.19507	1.65434
16	800	0.73653	1.62509	1.6228	0.91139	0.59743	0.68267	1.25698	1.74444		1.14417	1.5499
17	850	0.90456	2.04536	1.59953	1.01238	0.67992	0.75664	1.30855	1.74711	0.0977	1.21396	1.66894
18	900	1.06362	2.38398	1.55332	1.06915	0.72315	0.79116	1.30142	1.68705	0.12744	1.17541	1.56796
19	950	1.0338	2.34749	1.54861	1.11933	0.76846	0.85312	1.29998	1.72098	0.14678	1.10099	1.52503
20	1000	1.22341	2.75761	1.5288	1.16578	0.80963	0.88298	1.2975	1.69667	0.18704	1.15911	1.55733
21	1050	1.23317	2.79702	1.54534	1.21444	0.85264	0.93151	1.30607	1.72144	0.21098	1.12311	1.48857
22	1100	1.2055	2.67381	1.52172	1.19864	0.85622	0.94727	1.25385	1.71845	0.22458	1.054	1.46597
23	1150	1.3129	2.97111	1.5098	1.21886	0.88483	0.96261	1.24717	1.69912	0.26524	1.10808	1.46336
24	1200	1.29249	2.85624	1.51925	1.229	0.90826	1.00011	1.24152	1.72982	0.28269	1.06932	1.43407

Run R-79: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 75 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.94279	1.80611	1.24227	0.89624	0.79983	0.83425	0.92858	1.49398	0.58069	0.87045	1.15732
2	100	1.19608	2.56101	1.49093	1.15673	0.97941	1.01353	1.23998	1.72502	0.70126	1.10634	1.47585
3	150	1.10509	2.04184	0.96693	0.93749	0.81313	0.85404	0.95866	1.13495	0.53385	0.87698	1.08031
4	200	0.70071	1.12427	0.36318	0.61232	0.54711	0.59234	0.57896	0.4037	0.33027	0.54626	0.75543
5	250	0.45367	0.32075	0.12358	0.36319	0.35764	0.40474	0.31514	0.14859	0.19106	0.25863	0.4953
6	300	0.30985	0	0.05782	0.23113	0.22656	0.27305	0.18791	0.07074	0.14986	0.19821	0.37249
7	350	0.25003	0	0.03803	0.19273	0.19379	0.24185	0.16656	0	0.10291	0	0.09695
8	400	0.23521	0	0.02891	0.17308	0.17787	0.23263	0.1421	0	0.1108	0	0.18414
9	450	0.23768	0	0.02972	0.17108	0.17341	0.23526	0.13784	0	0.10781	0	0.08068
10	500	0.23935	0	0.0333	0.16945	0.17412	0.24085	0.14005	0	0.11621	0	0
11	550	0.23065	0	0.03649	0.15591	0.17816	0.2437	0.13735	0	0.1114	0	0
12	600	0.20705	0	0.03678	0.14611	0.16314	0.22896	0.12808	0	0.10617	0	0
13	650	0.19542	0	0.0378	0.12972	0.15184	0.21607	0.12153	0	0.09742	0	0
14	700	0.18081	0	0.03682	0.11744	0.14149	0.20465	0.11351	0	0	0	0
15	750	0.16001	0	0.03738	0.1075	0.1293	0.18889	0.10589	0	0	0	0
16	800	0.15003	0	0.03624	0.09817	0.12222	0.18184	0.10094	0	0	0	0
17	850	0.14172	0	0.03804	0.09279	0.11792	0.1762	0.09935	0	0	0	0
18	900	0.12699	0	0.03667	0.08446	0.11023	0.1671	0.09418	0	0	0	0

Run N-80: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, 15 psi, 110 C, Standard solution 200 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.05009	0	0	0	0	0	0	0	0	0	0
2	100	0	0	0	0	0	0	0	0	0	0	0
3	150	0	0	0	0	0	0	0	0	0	0	0
4	200	0	0	0	0	0	0	0	0	0	0	0
5	250	0	0	0	0	0	0	0	0.22653	0	0	0
6	300	0	0	0.15523	0	0	0	0	0.69185	0	0	0
7	350	0	0	1.07359	0	0.01519	0	0.17744	0.88136	0	0	0
8	400	0	0	1.50247	0	0	0.0517	0.44924	0.9397	0	0	0
9	450	0	0	1.56136	0	0	0.11267	0.74084	0.94445	0	0	0.1606
10	500	0	0	1.43754	0.17126	0.15558	0.25143	1.03037	0.96925	0	0	0.59104
11	550	0	0	1.28633	0.36931	0.26621	0.34408	1.18826	0.93896	0	0.04417	0.88045
12	600	0	0	1.23664	0.57176	0.37357	0.44149	1.32711	0.94751	0	1.08922	1.33182
13	650	0.16258	0	1.17202	0.82547	0.49145	0.55233	1.43924	0.95397	0	1.37376	1.4834
14	700	0.50426	0	1.08175	1.01189	0.56904	0.61592	1.39897	0.90502	0	1.37995	1.22926
15	750	0.81813	0	1.04899	1.19024	0.649	0.68719	1.38686	0.89577	0	1.30622	1.28627
16	800		0	1.01687	1.25653	0.69398	0.73371	1.32157	0.88447	0	1.22884	1.19119
17	850	1.19878	0	1.00053	1.33371	0.73996	0.78547	1.27263	0.87595	0	1.19146	1.16575
18	900	1.30663	0	0.99765	1.40897	0.79568	0.83855	1.23785	0.87999	0	1.17073	1.15617
19	950	1.41028	0	0.98651	1.44686	0.83083	0.87488	1.19597	0.8802	0	1.14972	1.1484
20	1000	1.18528	0	1.00142	1.50071	0.88099	0.91486	1.18215	0.88496	0	1.14386	1.16155
21	1050	1.34803	0	0.98799	1.5021	0.89401	0.92447	1.13366	0.86434	0	1.09965	1.1114

Run R-80: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, 10 psi, 110 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.97142	0	0.82104	0.94398	0.75181	0.75151	0.8181	0.73427	0.46818	0.81399	0.85402
2	100	0.45826	0	0.44988	0.41552	0.44087	0.45966	0.46894	0.4617	0.28394	0.34055	0.39136
3	150	0.60314	0	0.43819	0.38123	0.45248	0.43797	0.43477	0.39748	0.34223	0.35319	0.33125
4	200	0.99278	1.62821	0.78579	1.09541	1.02331	1.06939	1.06429	0.89315	0.78955	0.82821	0.86134
5	250	0.93421	0	0.13714	0.95514	0.77977	0.85634	0.66841	0.21843	0.73884	0.67673	0.52842
6	300	0.61759	0	0	0.48657	0.50369	0.60593	0.48787	0	0.47482	0	0.33591
7	350	0.40469	0	0	0.33313	0.41231	0.52277	0.38046	0	0.46388	0	0
8	400	0.32433	0	0	0.24405	0.3187	0.41505	0.23268	0	0	0	0
9	450	0.23584	0	0	0.13046	0.25353	0.35343	0.16612	0	0	0	0
10	500	0.22362	0	0	0.08303	0.22824	0.32194	0.14115	0	0	0	0
11	550	0.19845	0	0	0.06966	0.20653	0.29535	0.11838	0	0	0	0
12	600	0.16115	0	0	0	0.20103	0.27042	0.09918	0	0	0	0
13	650	0	0	0	0	0.15436	0.23621	0.08534	0	0	0	0
14	700	0	0	0	0	0.15835	0.24595	0.08157	0	0	0	0
15	750	0	0	0	0	0.16465	0.23109	0	0	0.18153	0	0
16	800	0	0	0	0	0.15658	0.19495	0	0	0.08208	0	0
17	850	0	0	0	0	0.15214	0.19288	0	0	0.07999	0	0
18	900	0	0	0	0	0.11118	0.17312	0	0	0	0	0
19	DR	0	0	0	0	0	0.09993	0	0	0	0	0

Run N-81: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, 15 psi, 110 C, Standard solution 200 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	0	0	0	0	0	0	0	0	0	0
2	100	0	0	0	0	0.05144	0.04366	0	0.33684	0	0	0
3	150	0	0	0.49842	0	0	0.11179	0.09275	1.07937	0	0	0
4	200	0.10457	0	1.74129	0.20367	0.12384	0.18804	0.5056	1.43646	0	0	0
5	250	0.25435	0	1.96715	0.50247	0.27768	0.27346	0.88952	1.51577	0	0.15214	0.26847
6	300	0.34052	0	1.85137	0.80596	0.46586	0.39027	1.14042	1.56396	0	0.52398	0.93632
7	350	0.3767	0	1.70275	1.01558	0.6295	0.49637	1.21611	1.59035	0	0.9602	1.16401
8	400	0.42413	0	1.63063	1.19134	0.77087	0.5993	1.24598	1.60434	0	1.27286	1.28497
9	450	0.50147	0	1.60226	1.29752	0.89076	0.69773	1.23024	1.65887	0	1.38906	1.31558
10	500	0.64398	0.55575	1.06171	1.13952	0.94307	0.7396	1.08056	1.02248	0.08293	0.93707	1.12352
11	550	0.74766	0.78301	1.05706	1.13775	0.97956	0.78896	1.04406	1.02992	0.782	0.96118	1.03409
12	600	0.81488	0.9345	1.0514	1.13192	1.0094	0.83795	1.02415	1.04059	0.23492	0.90787	1.00541
13	650	0.87512	1.01331	1.03326	1.1079	1.10602	0.87186	1.00056	1.05321	0.27565	0.8912	0.97749
14	700	0.51513	1.00001	1.05858	1.09153	1.03747	0.89637	1.00145	1.08155	0.25595	0.83884	0.94861
15	750	0.94367	1.07741	1.03937	1.05504	1.04465	0.92312	0.98839	1.09855	0.3506	0.86782	0.90362
16	800	0.96447	1.0393	1.03148	1.00259	1.03604	0.92252	0.96423	1.09563	0.33512	0.83252	0.91715
17	850	0.96335	0.96468	1.04207	0.99207	1.07981	0.97276	0.98506	1.14131	0.44836	0.86211	0.92883
18	900	0.98188	1.01534	1.02098	0.95676	1.04961	0.95225	0.9576	1.10627	0.45674	0.83534	0.84599

Run R-81: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, 5 psi, 110 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.94632	0.72108	0.89338	0.78612	0.89153	0.86702	0.84077	1.01735	0.64353	0.73675	0.85064
2	100	2.03108	1.20256	0.93646	0.9603	1.0503	1.06838	0.93945	1.01701	0.95323	0.86398	0.89698
3	150	0.86699	0.59682	0.89504	0.73831	0.77136	0.84305	0.81453	1.02146	0.57395	0.65389	0.9489
4	200	0.75616	0.39695	0.18927	0.555	0.63167	0.70315	0.46757	0.28904	0.44861	0.30524	0.41077
5	250	0.55603	0	0.05618	0.3945	0.41372	0.54458	0.26022	0.16854	0.43533	0.27378	0.30221
6	300	0.54481	0	0	0.22956	0.28307	0.38568	0.13336	0	0.2702	0	0
7	350	0.28117	0	0	0.19784	0.23362	0.3526	0.12236	0	0.21859	0	0
8	400	0.39929	0	0	0.08397	0.1284	0.1976	0.06572	0	0	0	0
9	450	0.17242	0	0	0.12309	0.17277	0.28402	0.07391	0	0.15903	0	0
10	500	0.26471	0	0	0.04095	0.08064	0.14369	0.04156	0	0	0	0
11	550	0.32361	0	0	0	0	0.12192	0	0	0	0	0
12	600	0.23116	0	0	0	0	0.13344	0	0	0	0	0
13	650	0.15301	0	0	0.04514	0.07559	0.16063	0.03993	0	0	0	0
14	700	0.10777	0	0	0.04174	0.07973	0.16849	0	0	0	0	0
15	750	0.084	0	0	0	0.07162	0.1594	0	0	0	0	0
16	800	0.07314	0	0	0	0.06581	0.14986	0	0	0	0	0
17	850	0.07043	0	0	0	0.06168	0.13948	0	0	0	0	0
18	900	0.07035	0	0	0	0	0.13962	0	0	0	0	0
19	DR	0.70722	0	0	0.16435	0.28597	0.44307	0.0296	0	0.25693	0	0

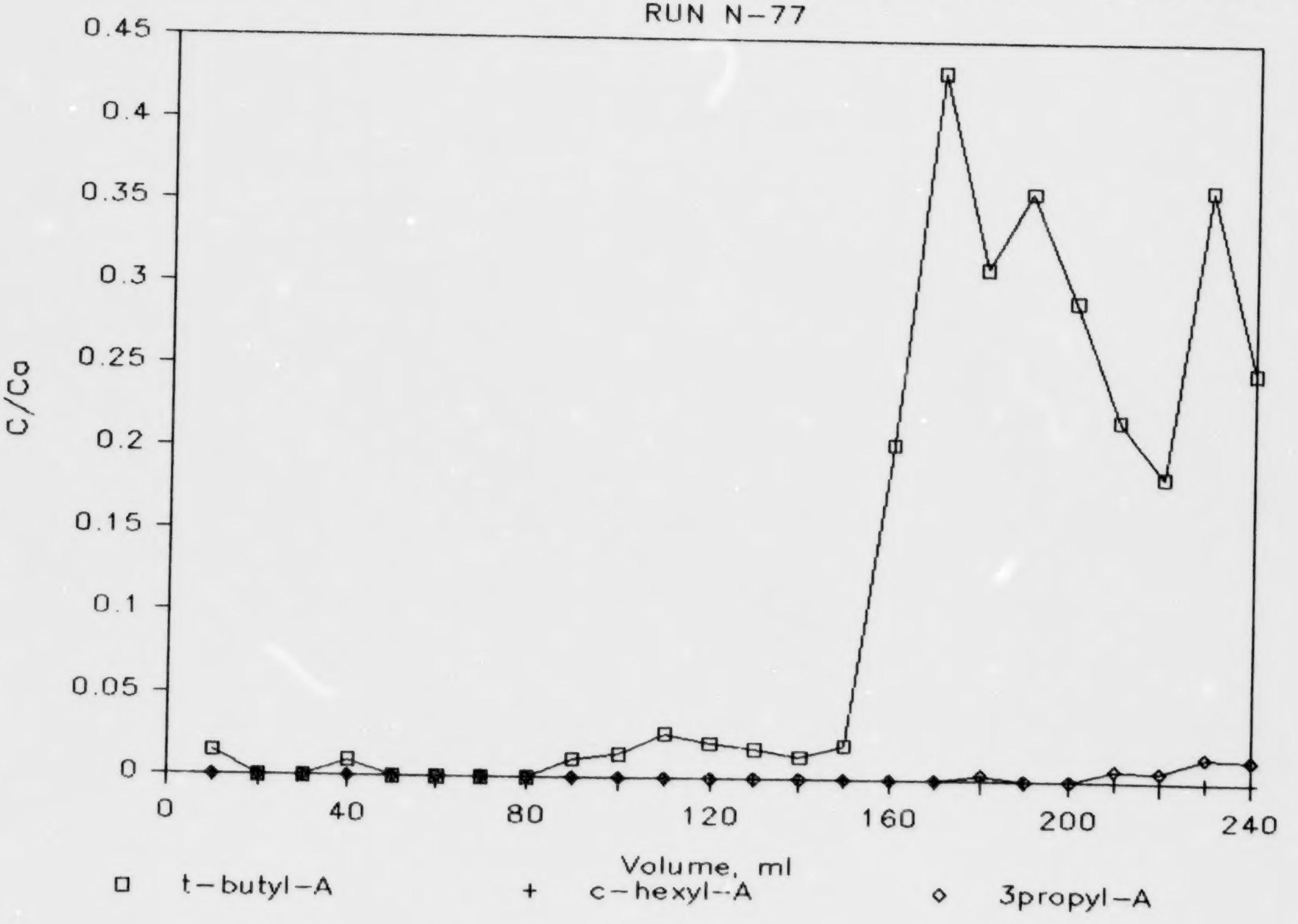
Run N-82: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, 15 psi, 110 C, Standard solution 200 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	0	0	0	0	0	0	0	0	0	0
2	100	0	0	0	0	0	0	0	0	0	0	0
3	150	0	0	0	0	0	0	0	0.27721	0	0	0
4	200	0	0	0.81376	0	0	0	0	0.94761	0	0	0
5	250	0.03558	0	1.5465	0	0	0	0	1.23317	0	0	0
6	300	0.04751	0	1.70428	0	0	0	0.09476	1.34854	0	0	0
7	350	0.04371	0	1.83794	0	0	0.0449	0.3045	1.64008	0	0.38179	0.14682
8	400	0.02616	0	1.63197	0.0527	0	0.10822	0.51169	1.56671	0	0.344	0.29402
9	450	0.11475	0	1.49178	0.14944	0.08027	0.17558	0.71731	1.49739	0	0.91396	0.47802
10	500	0.26502	0	1.47911	0.27796	0.18252	0.28386	0.98036	1.62532	0	1.16744	0.64293
11	550	0.29942	0.63297	1.40984	0.41533	0.30404	0.39745	1.15628	1.59983	0	1.1968	0.63849
12	600	0.56893	1.05424	1.35845	0.54606	0.41094	0.49654	1.27956	1.56263	0	1.15411	0.58941
13	650	0.66105	1.42962	1.32693	0.66637	0.51167	0.58713	1.36168	1.52647	0	1.10901	0.55642
14	700	0.76102	1.63037	1.29034	0.74305	0.59269	0.6464	1.38998	1.48472	0	1.03683	0.50978
15	750	0.78283	1.72171	1.28392	0.62725	0.67235	0.72832	1.41682	1.48431	0	0.96834	0.8312
16	800	0.80724	1.7277	1.28968	0.90582	0.75871	0.81357	1.4394	1.51777	0	0.9835	0.47039
17	850	0.79342	1.63596	1.2897	0.96757	0.83461	0.88791	1.43789	1.54612	0.14732	0.96458	0.46456
18	900	0.7854	1.62169	1.27164	0.99522	0.87069	0.91653	1.37448	1.51021	0.17504	0.92615	0.41315

Run R-82: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 110 C, Toluene as regeneration solvent

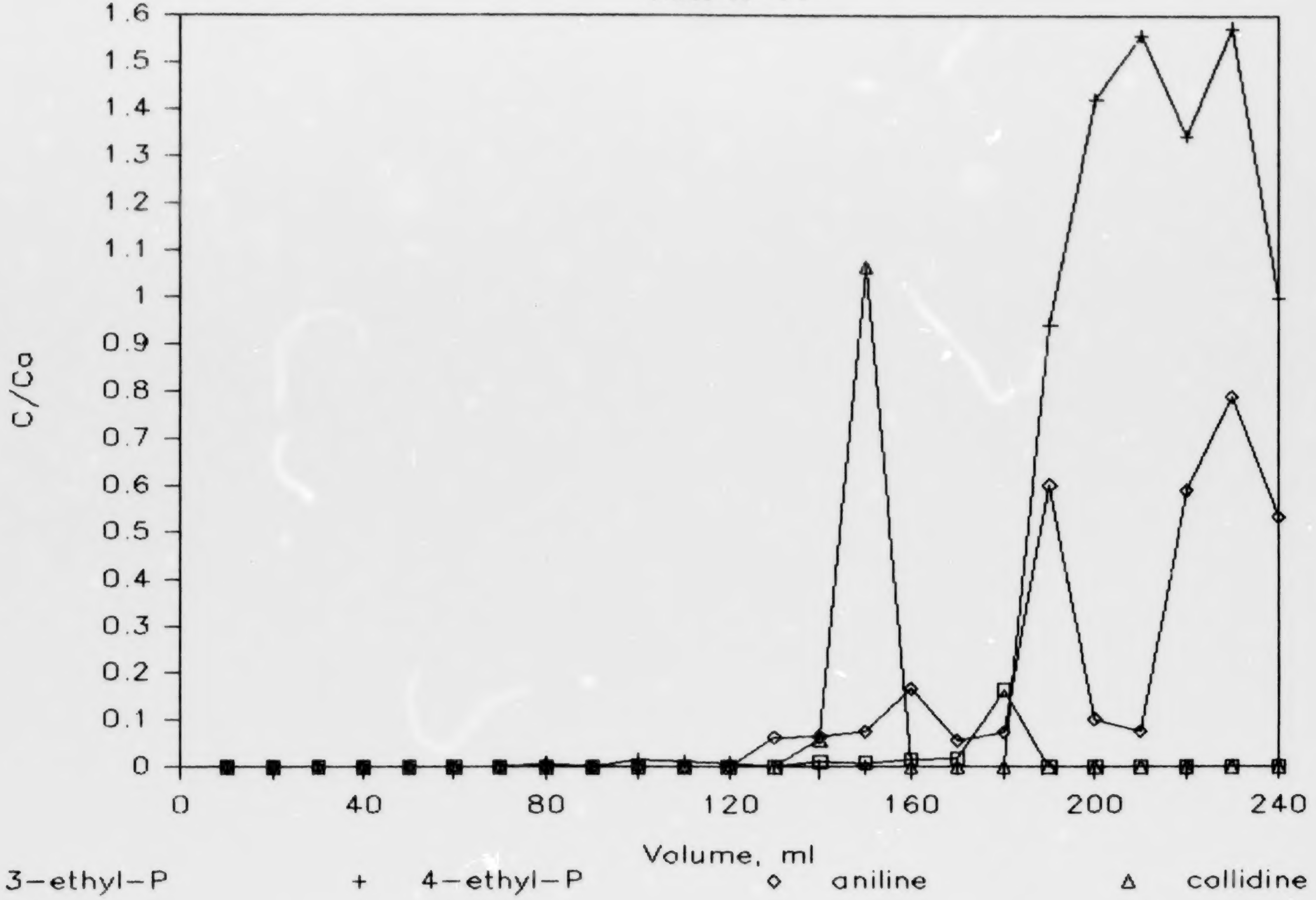
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.6981	1.18096	1.06186	0.86127	0.8408	0.87158	1.02487	1.27367	0.55042	0.81851	0.2853
2	100	1.13657	0.98093	0.99891	0.84772	0.83153	0.89946	0.9826	1.20189	0.60415	0.66973	0.6057
3	150	0.92403	1.02499	0.79406	0.85278	0.81829	0.89672	0.9913	1.11262	0.64081	0.77939	0.51804
4	200	0.36329	0.494	0.187	0.63114	0.61299	0.7324	0.69474	0.47654	0.36344	0.30181	0.262
5	250	0.44156	0	0.05229	0.52646	0.54158	0.67029	0.54542	0.22898	0.37055	0.19641	0.12644
6	300	0.38073	0	0	0.39276	0.43753	0.56529	0.39999	0	0.29243	0	0
7	350	0.26801	0	0	0.32835	0.34973	0.46284	0.34291	0	0.17817	0	0
8	400	0.24522	0	0	0.26113	0.28474	0.39194	0.26578	0	0.14176	0	0
9	450	0.12906	0	0	0.19548	0.22287	0.30477	0.19618	0	0.09481	0	0
10	500	0.11004	0	0	0.16486	0.19637	0.26699	0.16217	0	0	0	0
11	550	0.10813	0	0	0.1718	0.21066	0.28345	0.16113	0	0	0	0
12	600	0.08293	0	0	0.16297	0.20589	0.28107	0.14443	0	0.08228	0	0
13	650	0.05764	0	0	0.11955	0.15522	0.2181	0.10575	0	0	0	0
14	700	0.04763	0	0	0.10543	0.14435	0.20275	0.09534	0	0	0	0
15	750	0.05053	0	0	0.10508	0.14785	0.20698	0.09349	0	0	0	0
16	800	0.04205	0	0	0.10306	0.14738	0.20664	0.08855	0	0	0	0
17	850	0.06366	0	0	0.10052	0.14012	0.19258	0.08061	0	0	0	0
18	900	0.05098	0	0	0.10094	0.14592	0.20707	0.08416	0	0	0	0
19	DR	0.08029	0	0	0.04575	0.08818	0.13544	0.03608	0	0	0	0

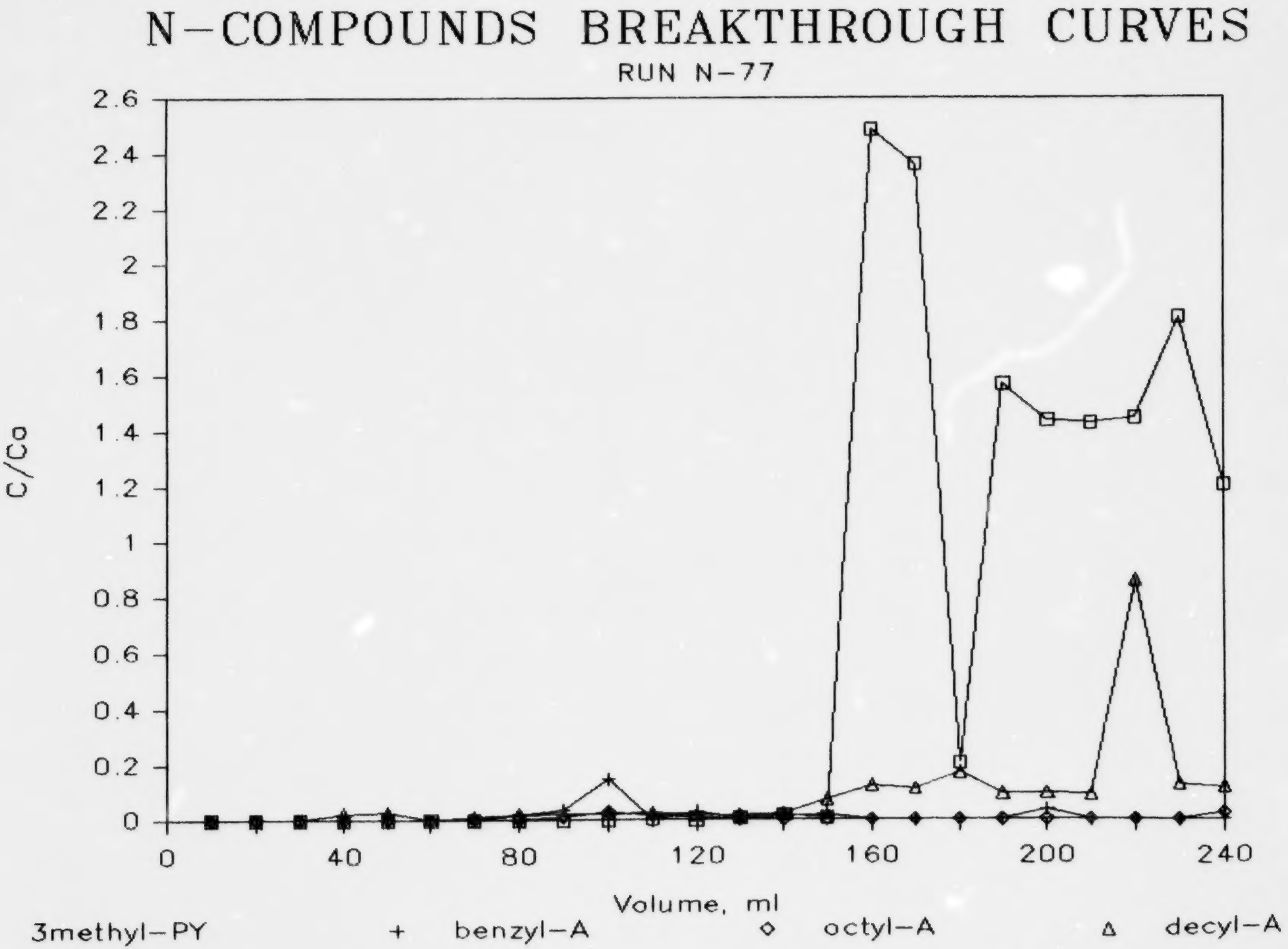
N-COMPOUNDS BREAKTHROUGH CURVES



N–COMPOUNDS BREAKTHROUGH CURVES

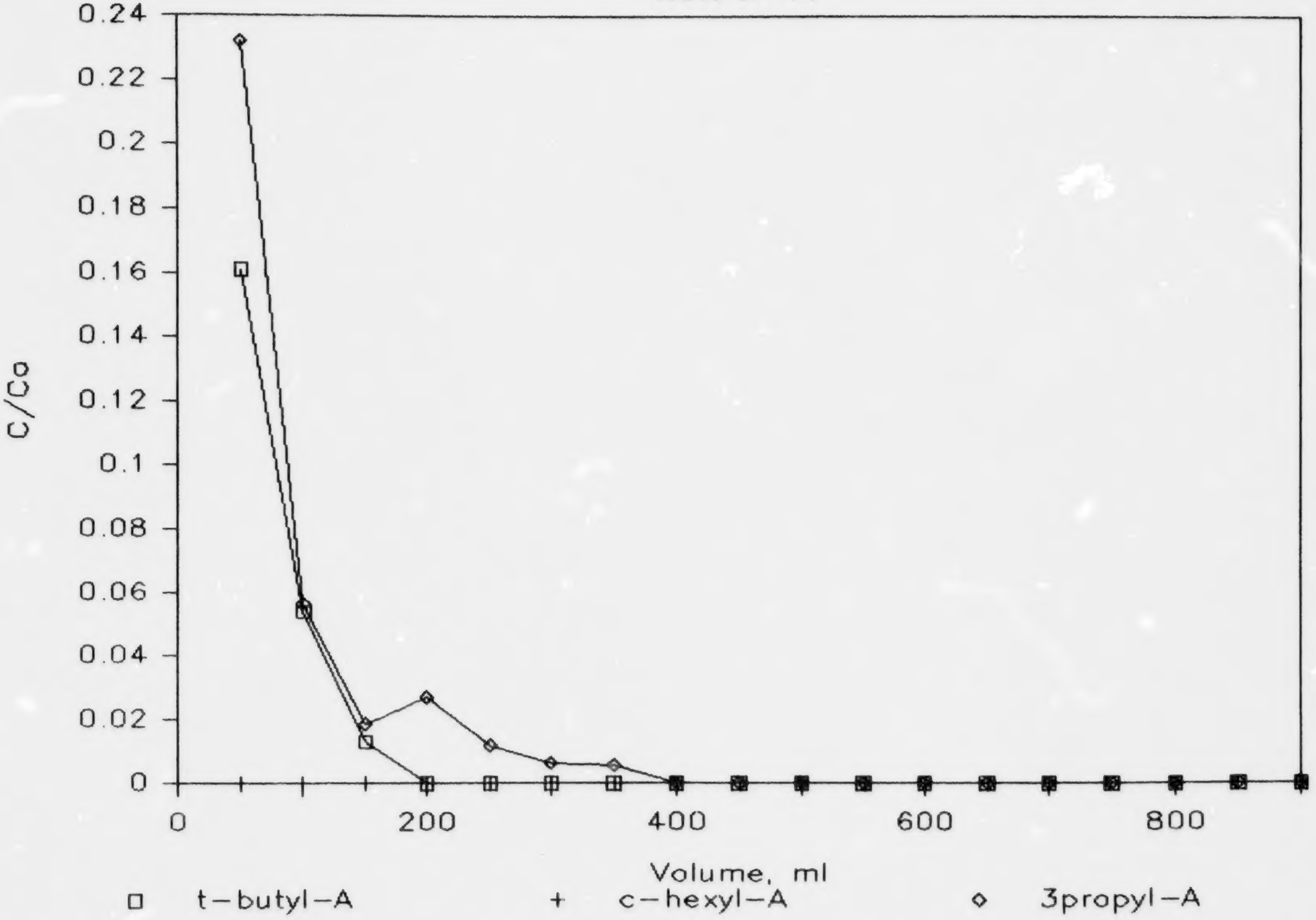
RUN N–77




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-77
C/Co
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
40
80
120
160
200
240
Volume, ml
3methyl-PY
+ benzyl-A
◇ octyl-A
Δ decyl-A

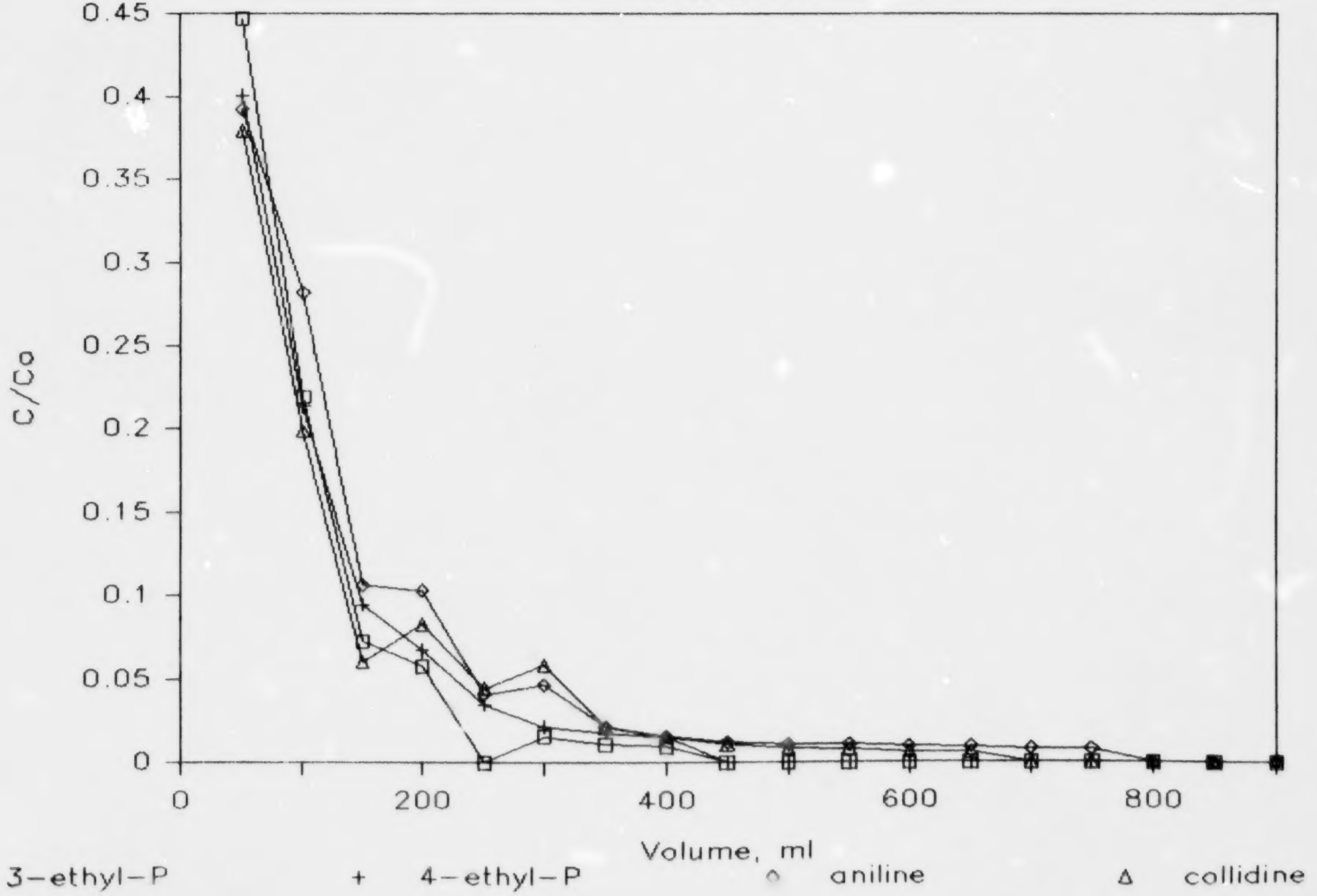
N-COMPOUNDS DESORPTION CURVES

RUN R-77



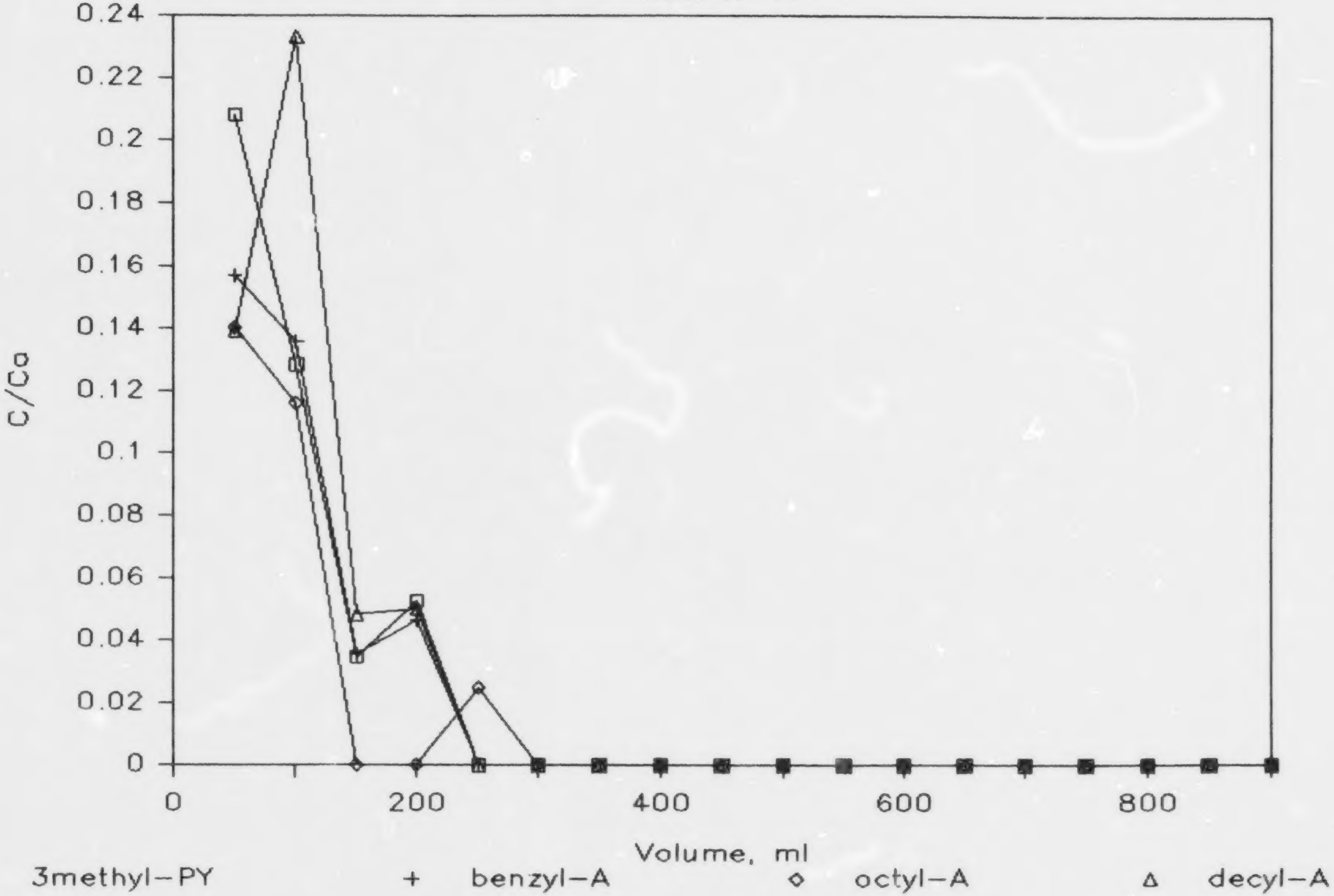
N–COMPOUNDS DESORPTION CURVES

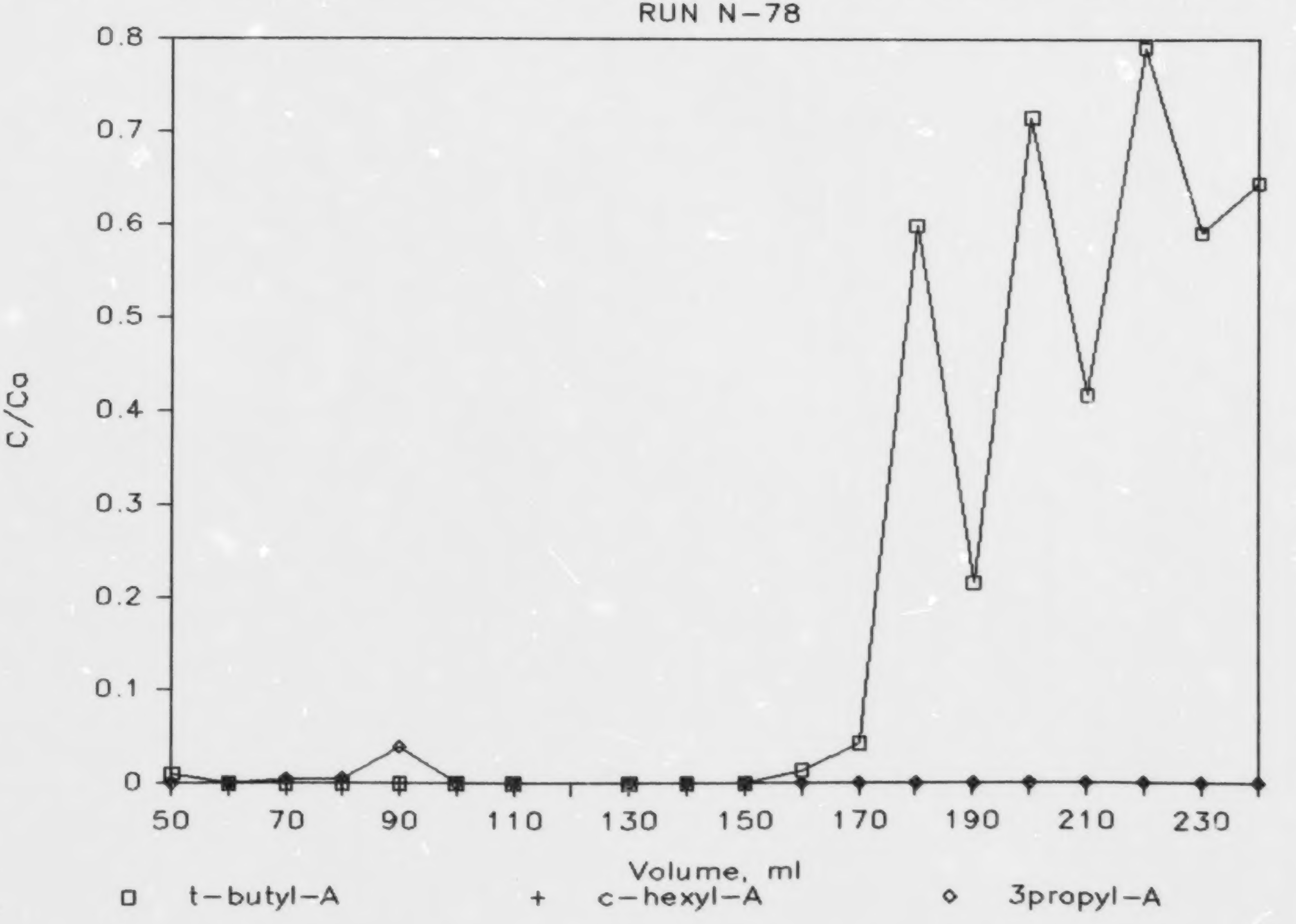
RUN R–77



N–COMPOUNDS DESORPTION CURVES

RUN R–77



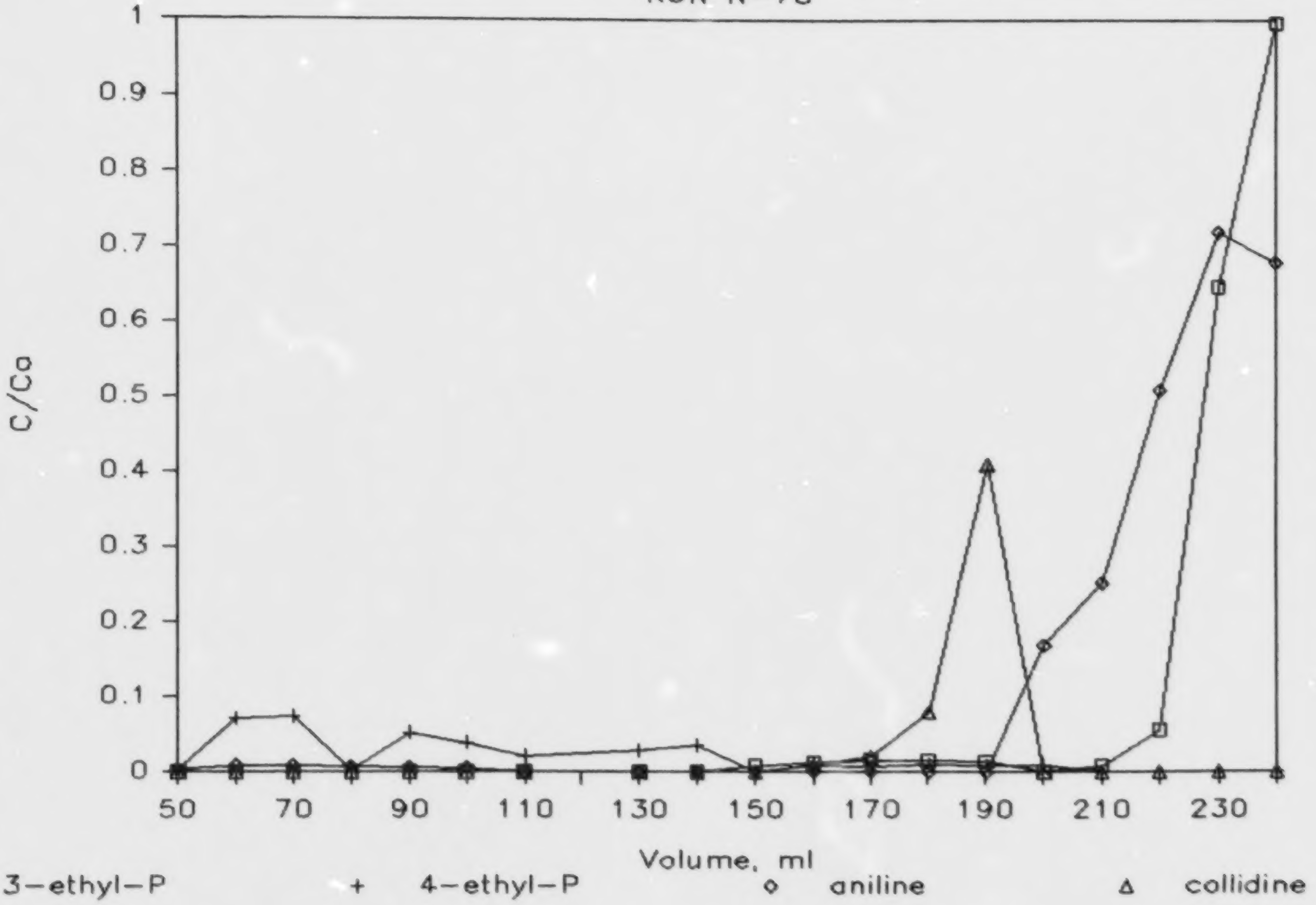


N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-78

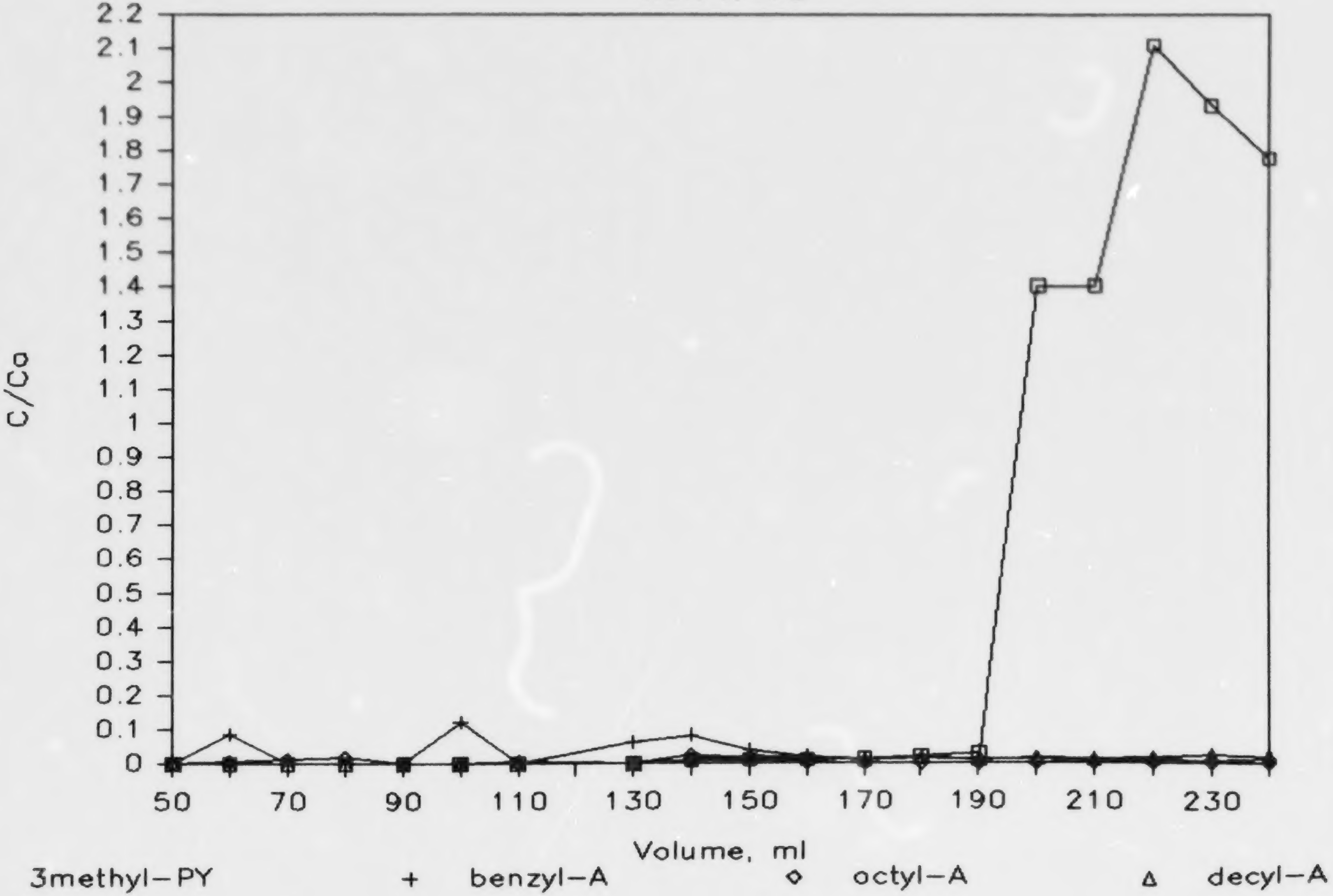
N-COMPOUNDS BREAKTHROUGH CURVES

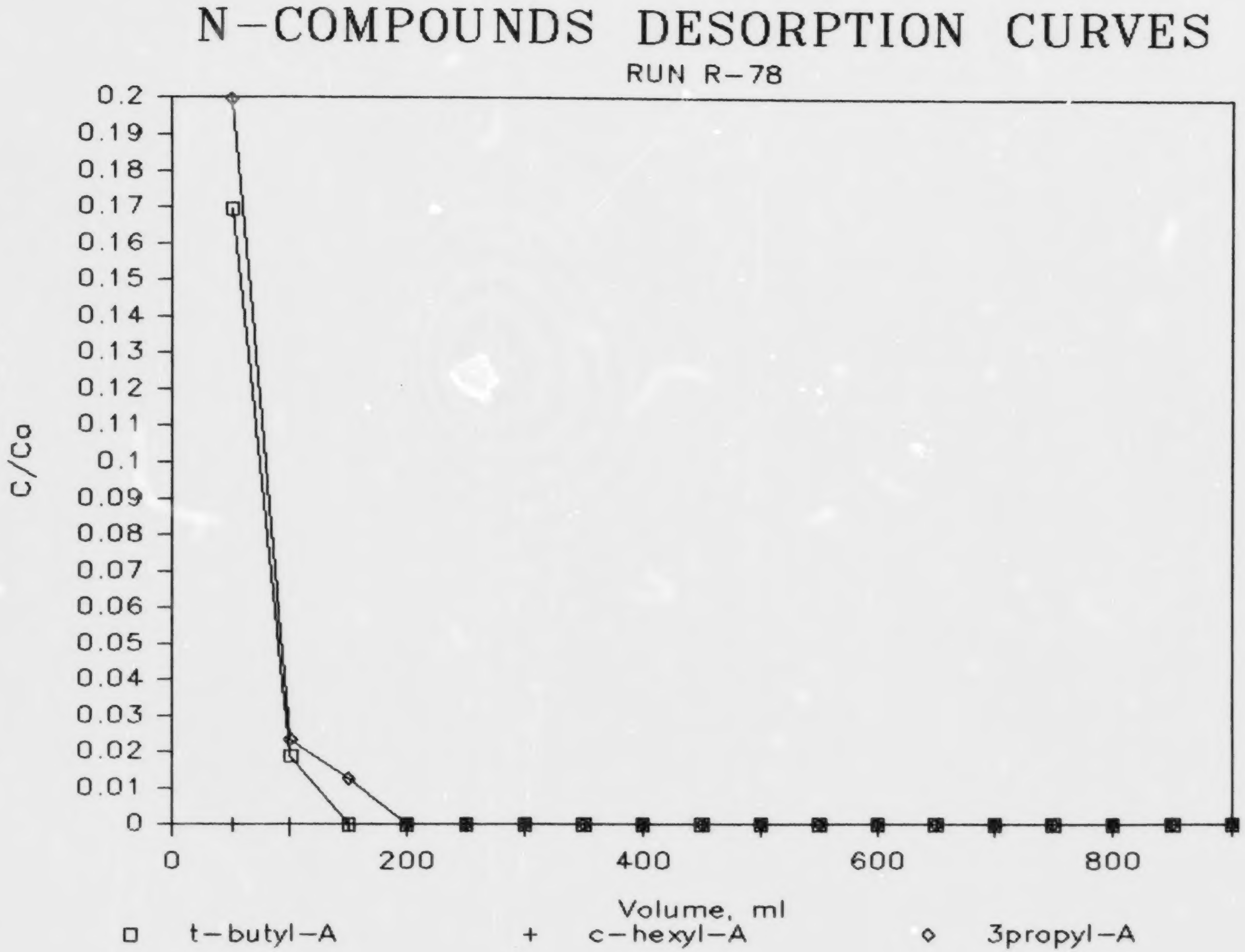
RUN N-78



N-COMPOUNDS BREAKTHROUGH CURVES

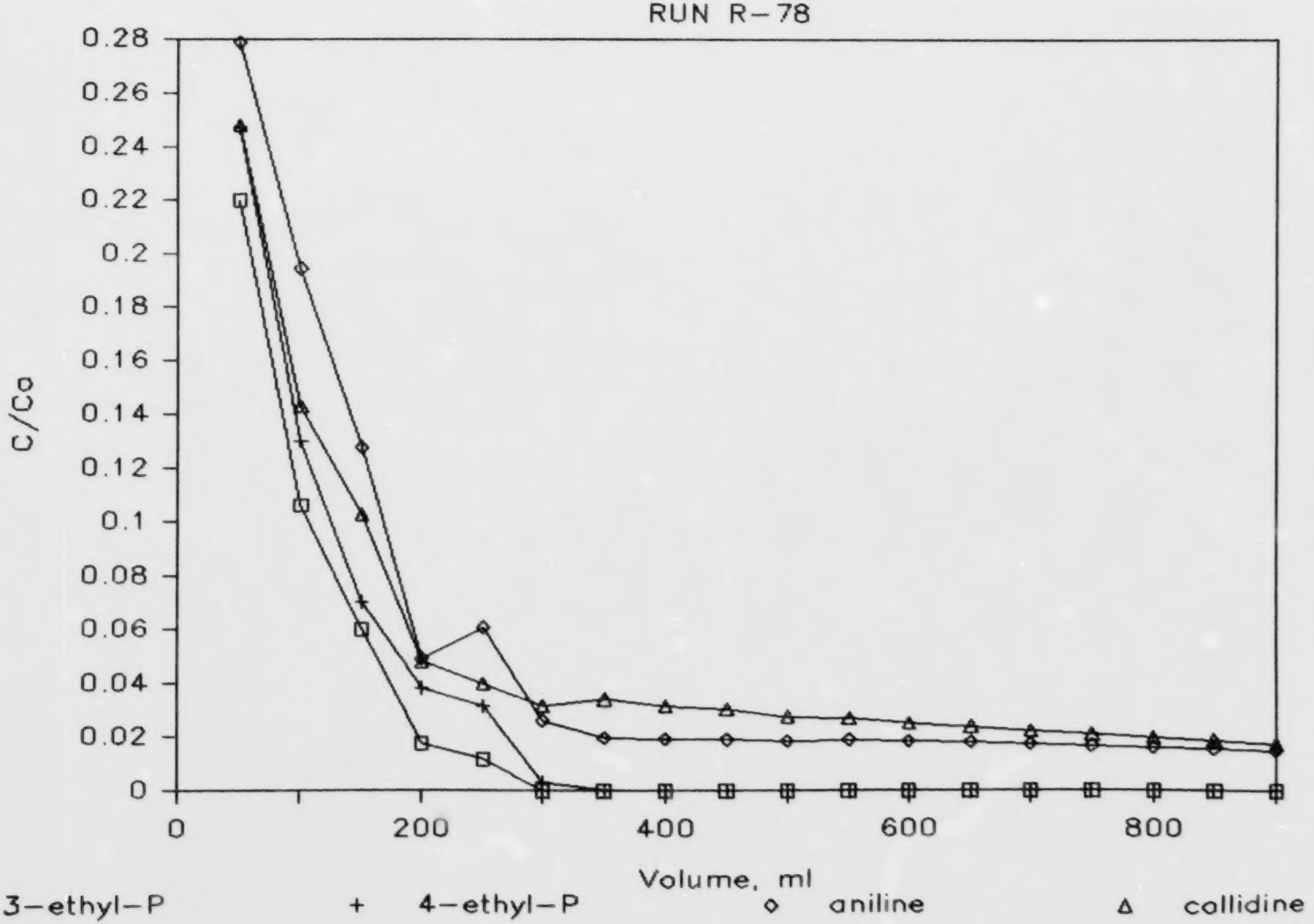
RUN N-78

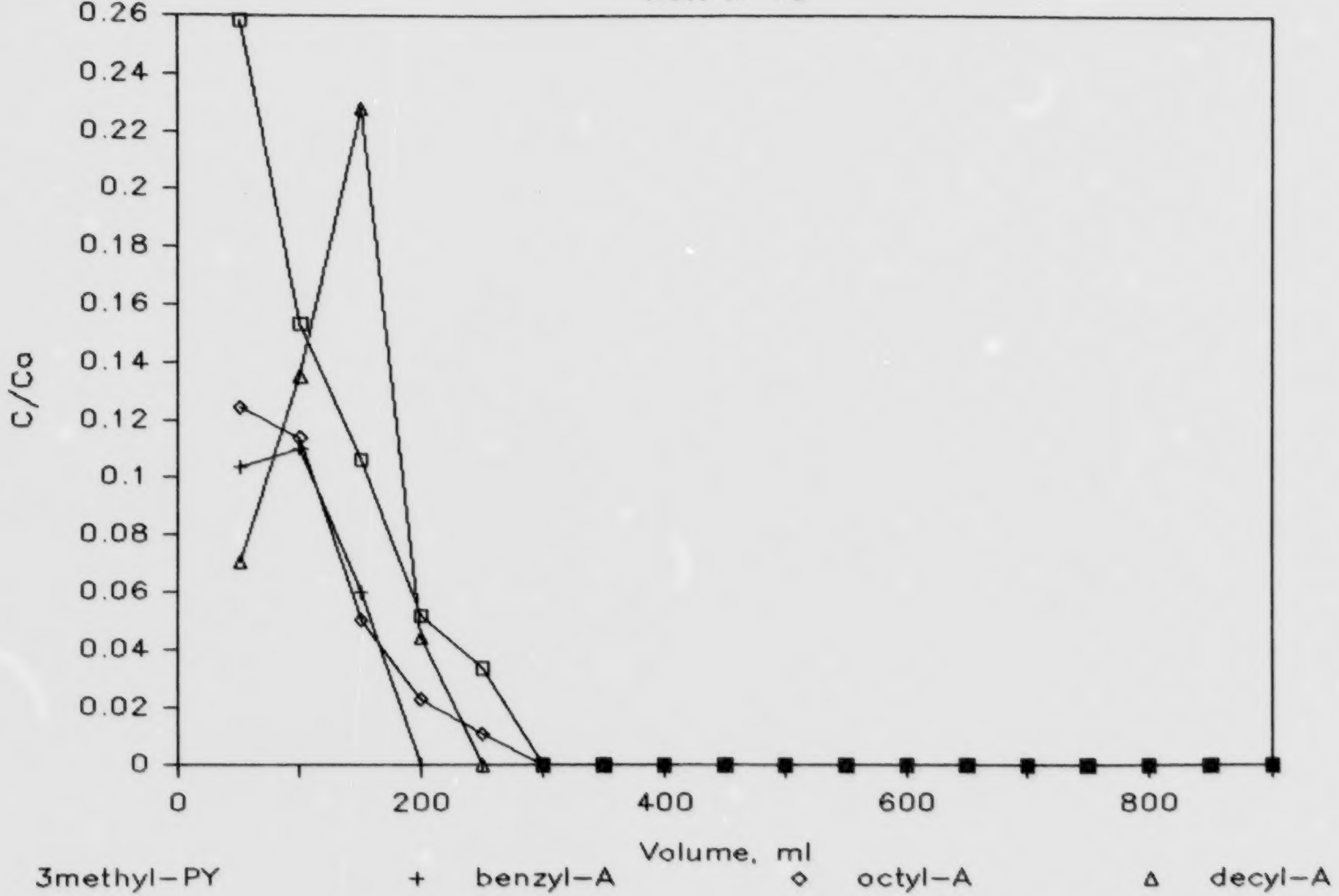



N-COMPOUNDS DESORPTION CURVES
RUN R-78
C/Co
0.2
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
200
400
600
800
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

N-COMPOUNDS DESORPTION CURVES

RUN R-78



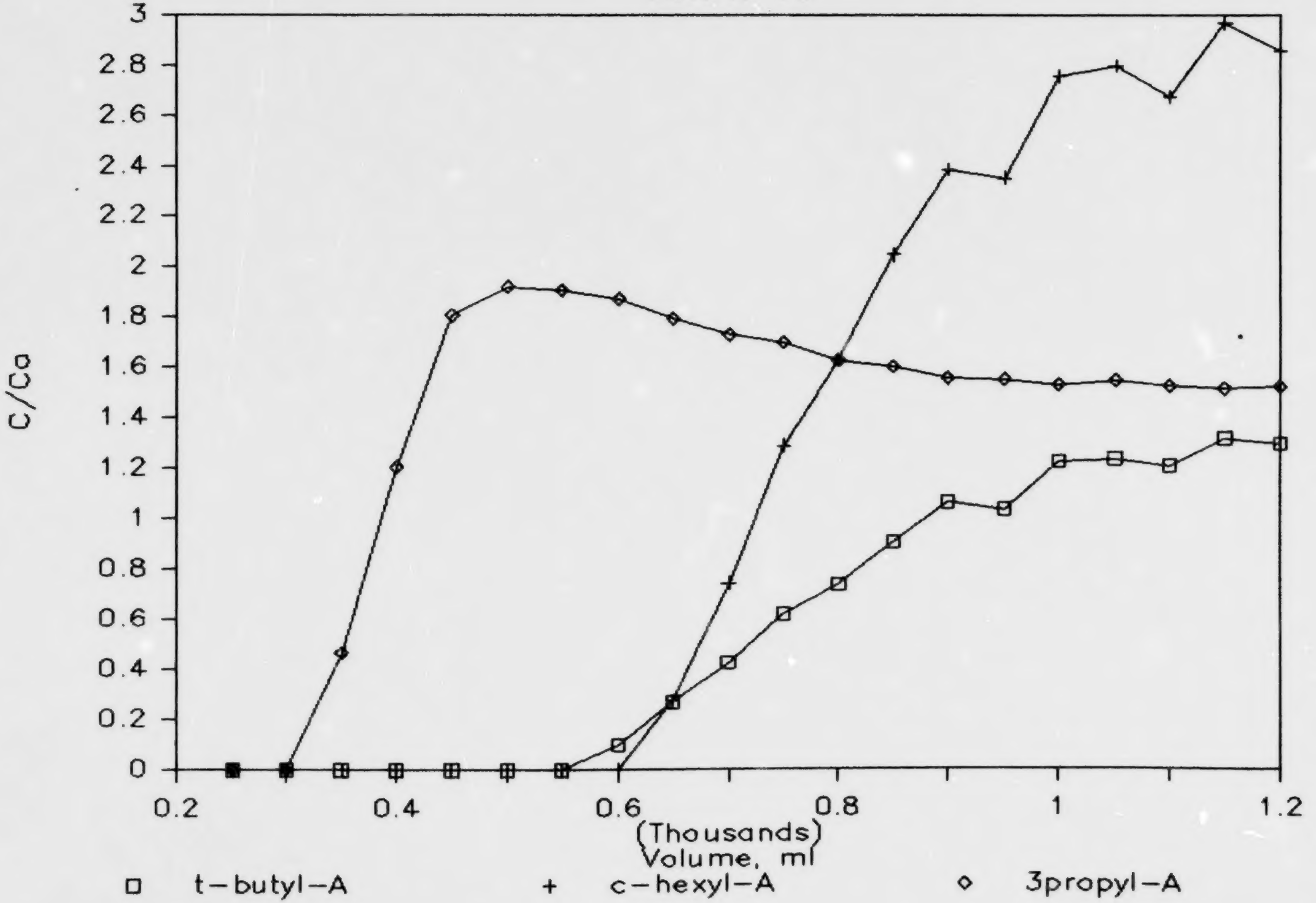


N-COMPOUNDS DESORPTION CURVES

RUN R-78

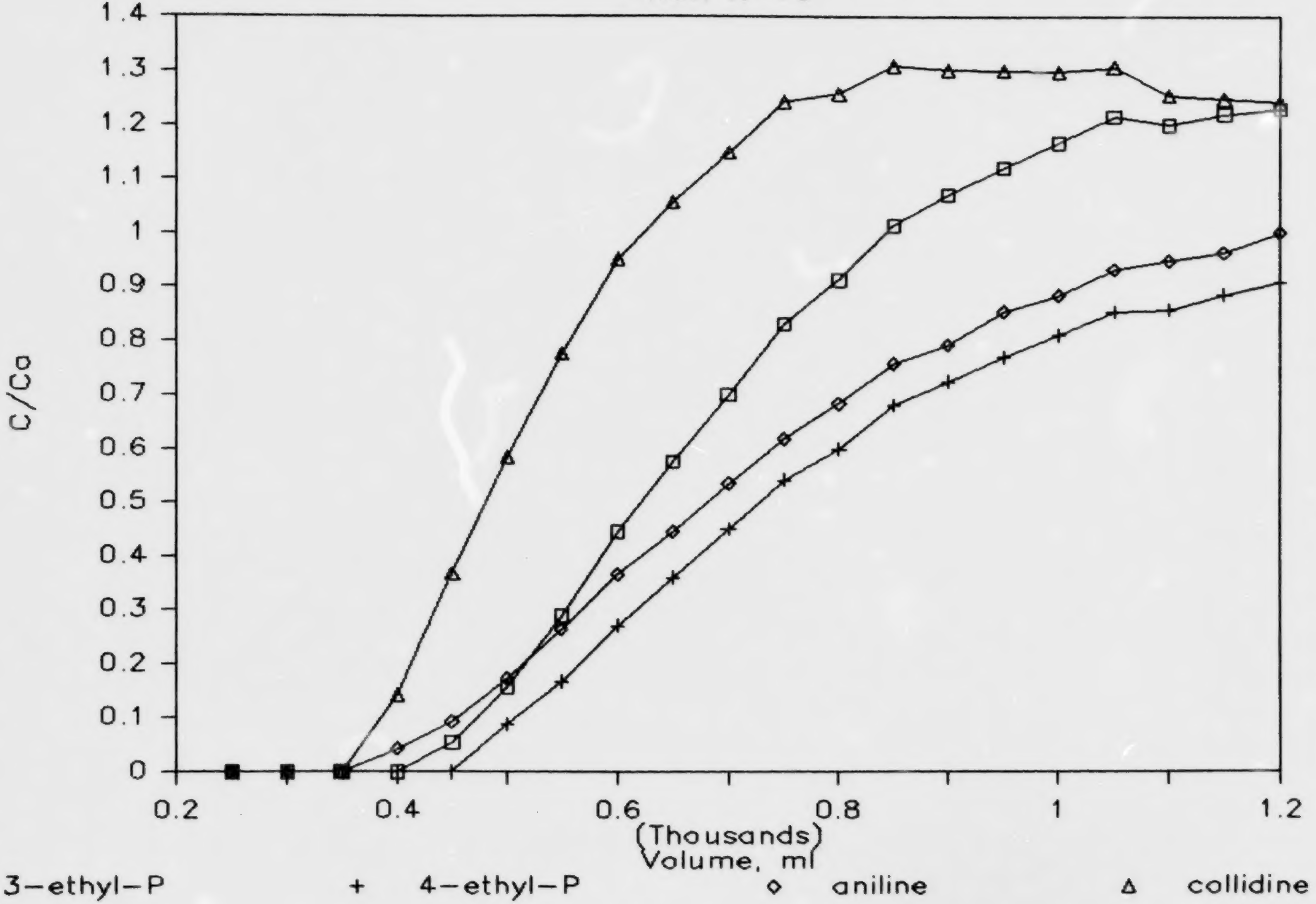
N-COMPOUNDS BREAKTHROUGH CURVES

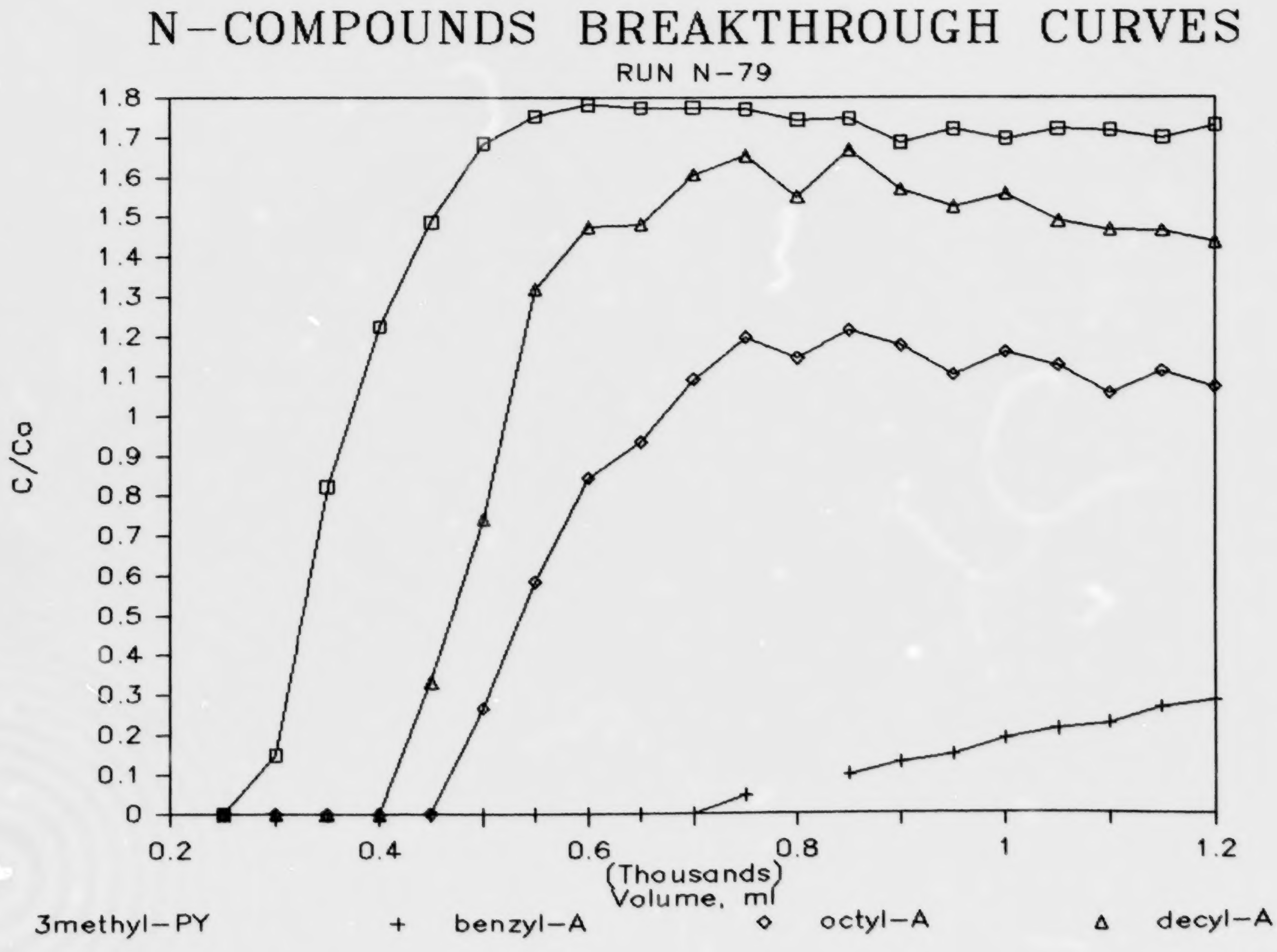
RUN N-79



N-COMPOUNDS BREAKTHROUGH CURVES

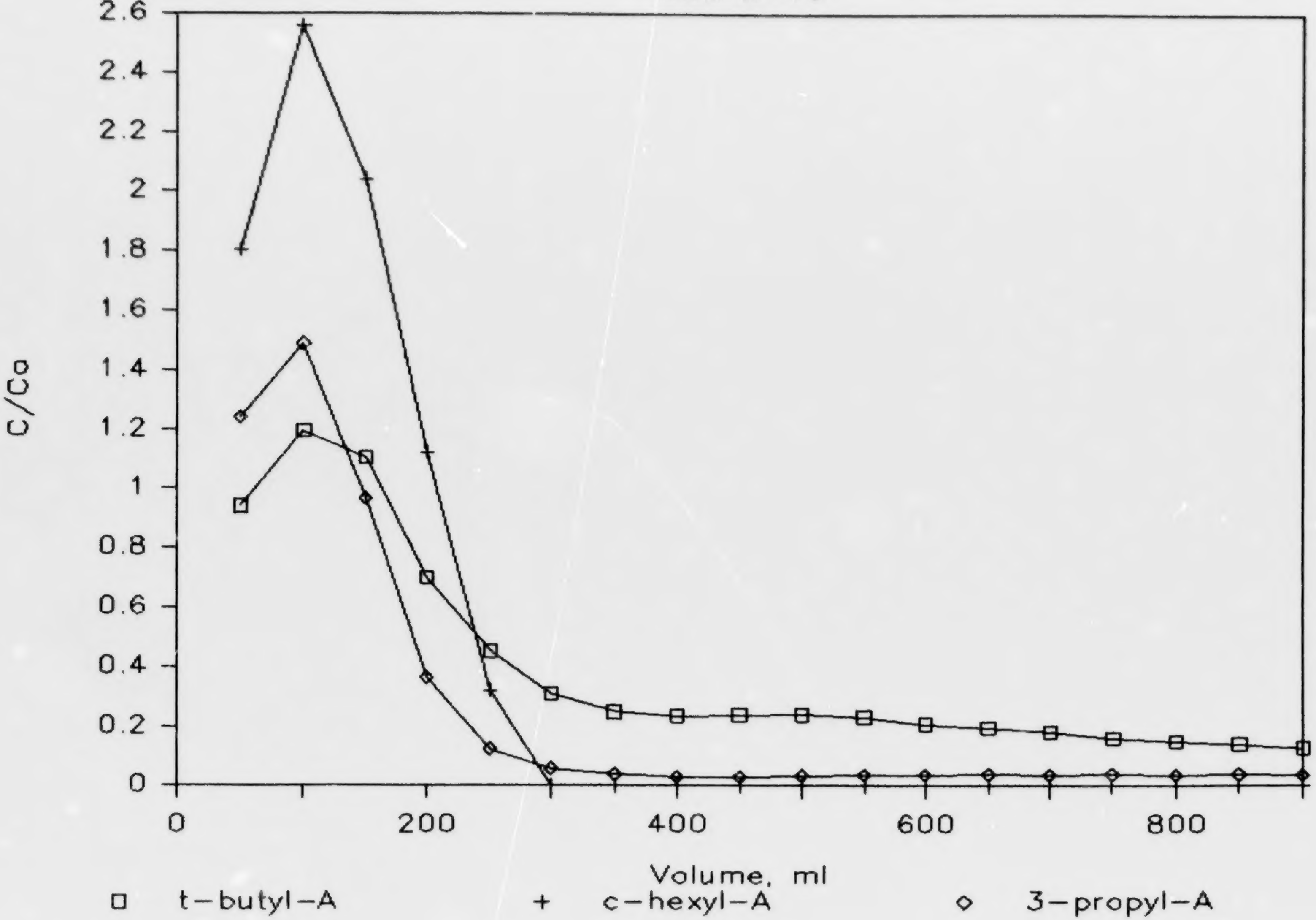
RUN N-79




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-79
C/Co
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.2
0.4
0.6
0.8
1
1.2
(Thousands)
Volume, ml
3methyl-PY
+ benzyl-A
◇ octyl-A
△ decyl-A

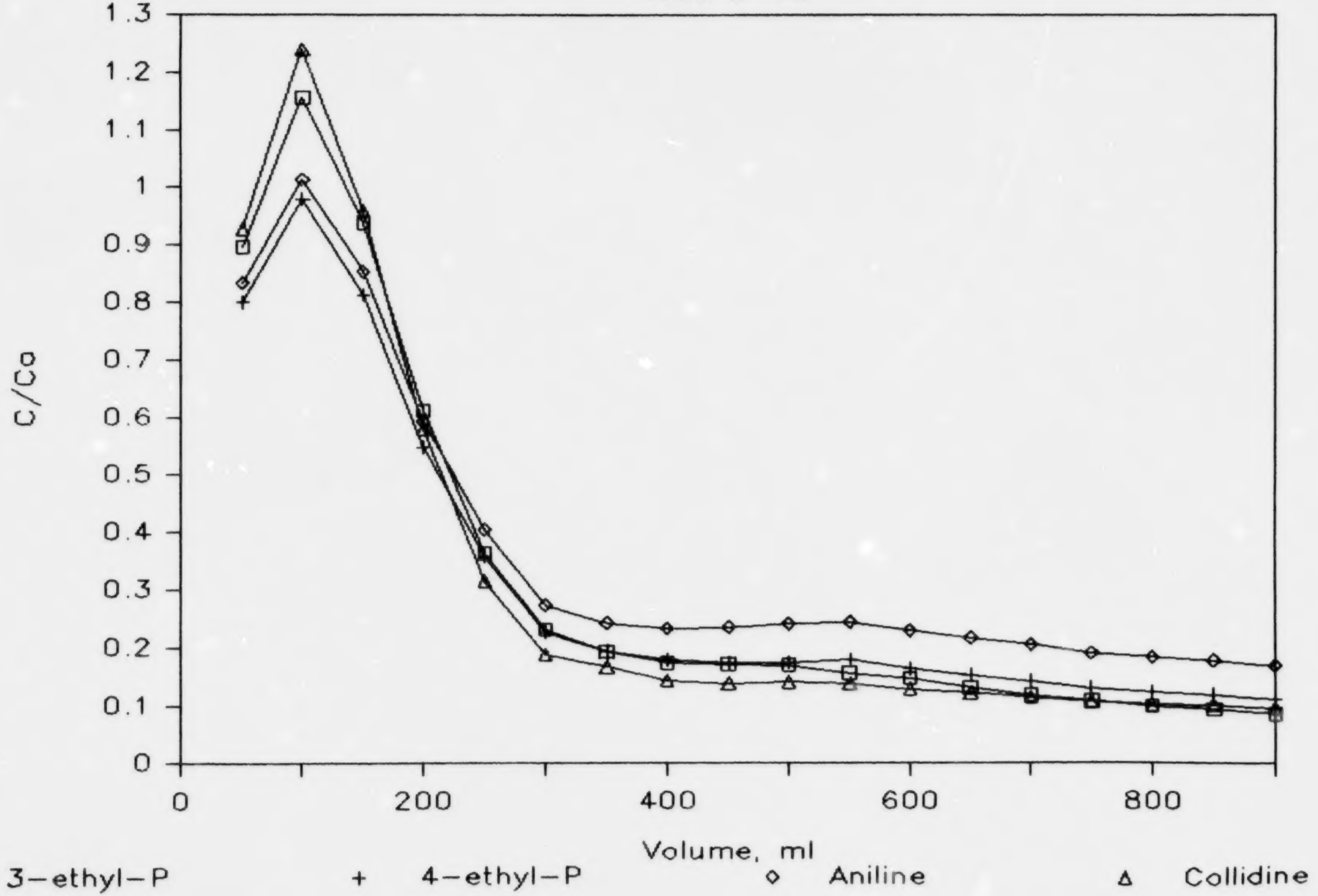
N-COMPOUNDS DESORPTION CURVES

RUN R-79



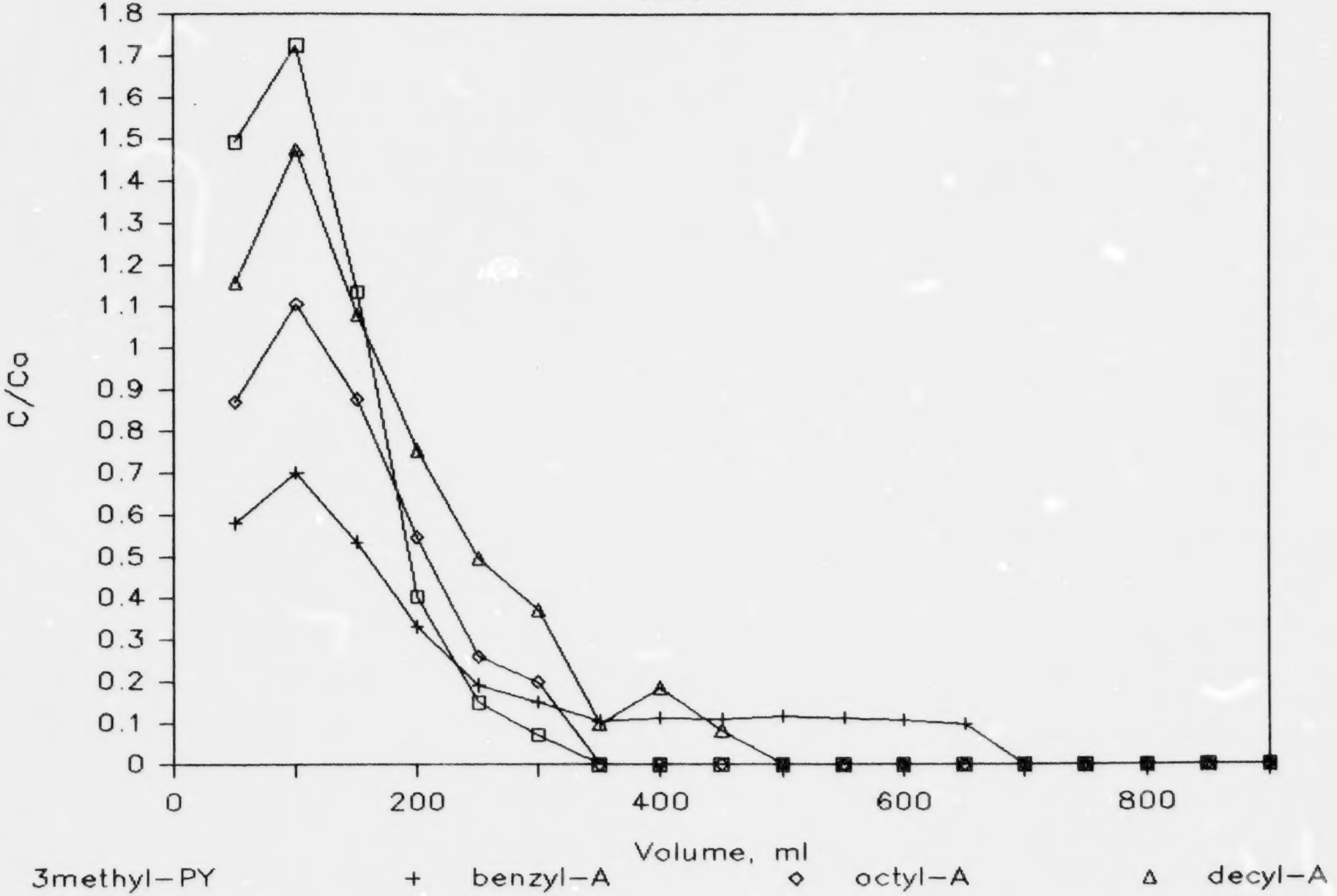
N-COMPOUNDS DESORPTION CURVES

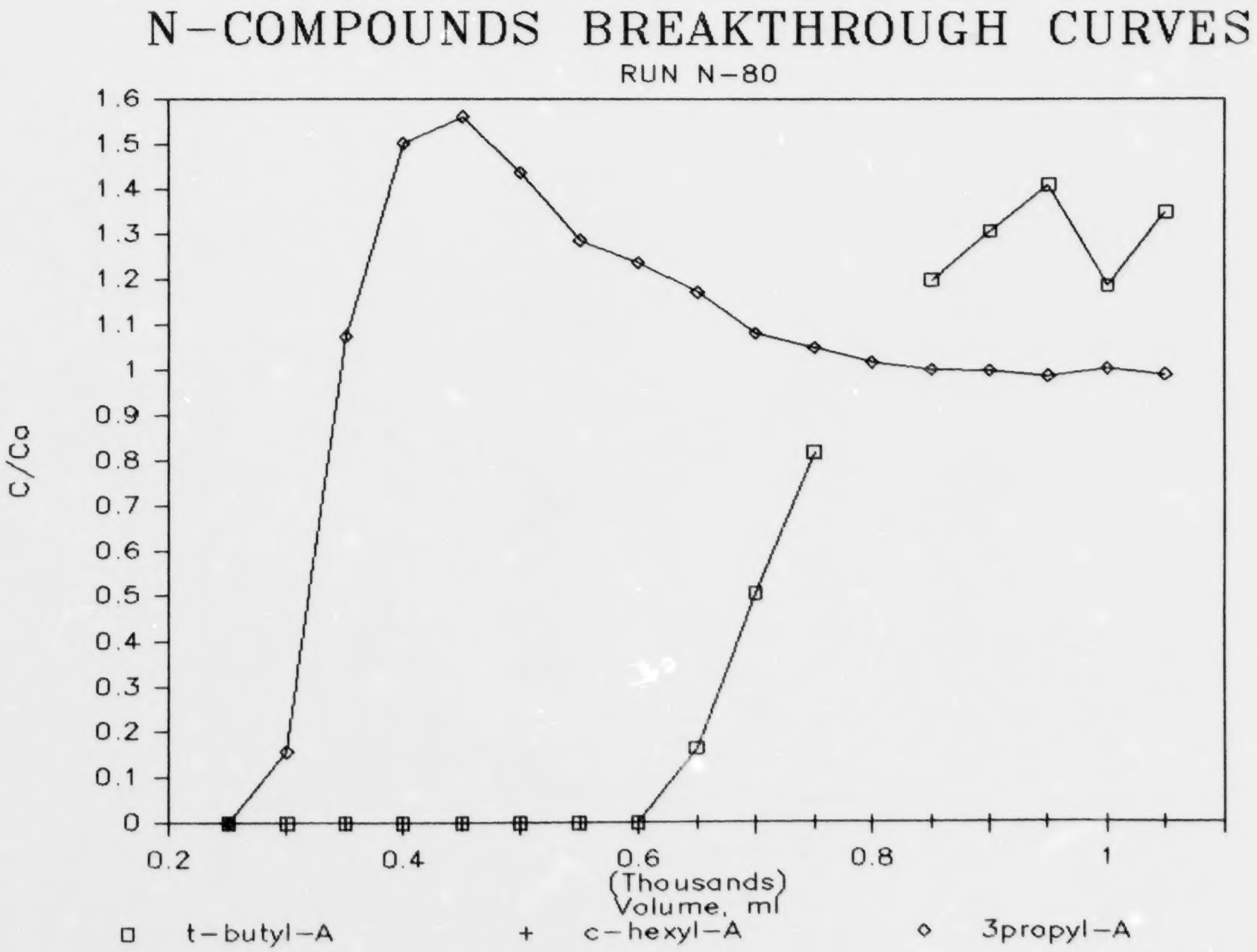
RUN R-79



N-COMPOUNDS DESORPTION CURVES

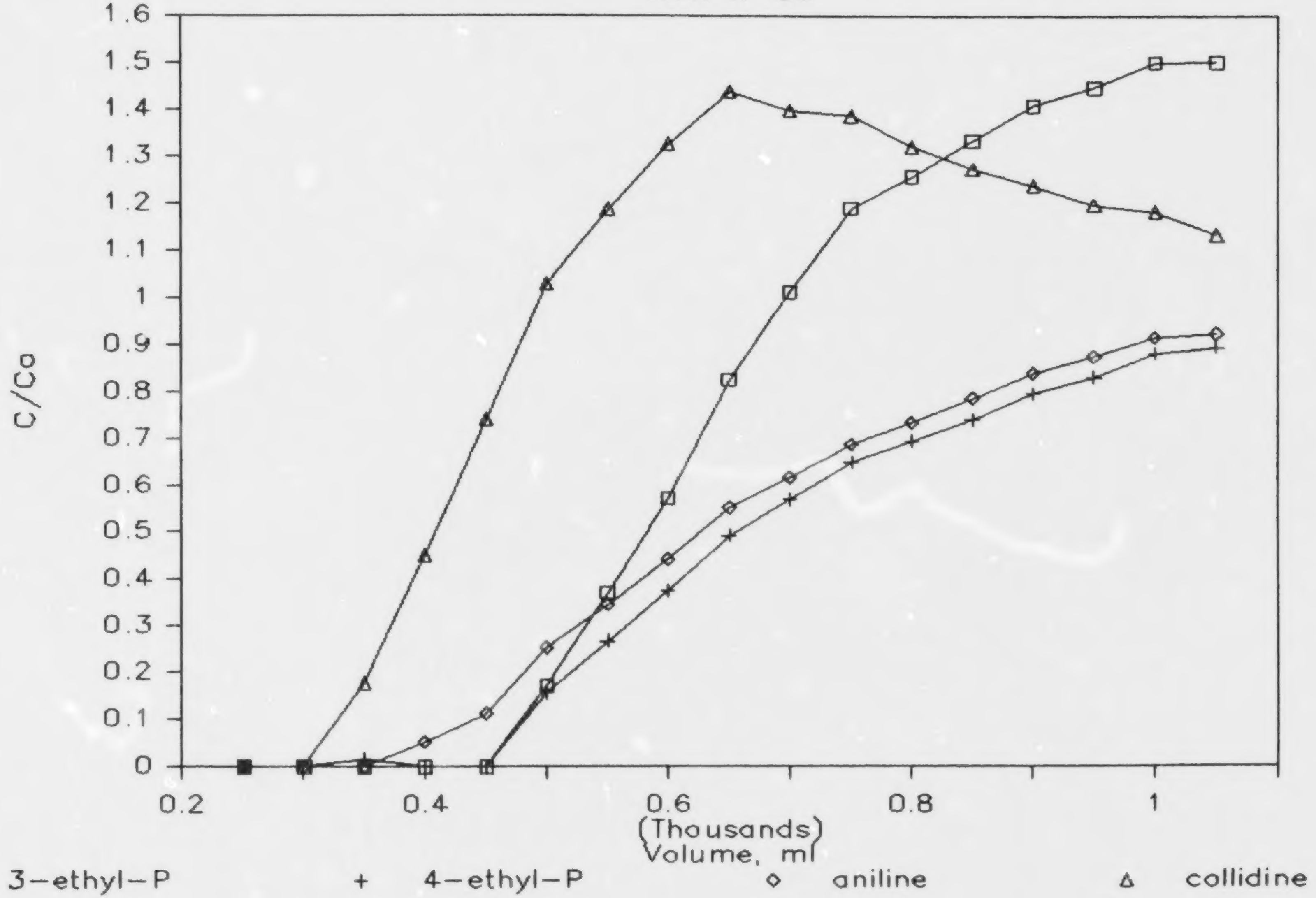
RUN R-79



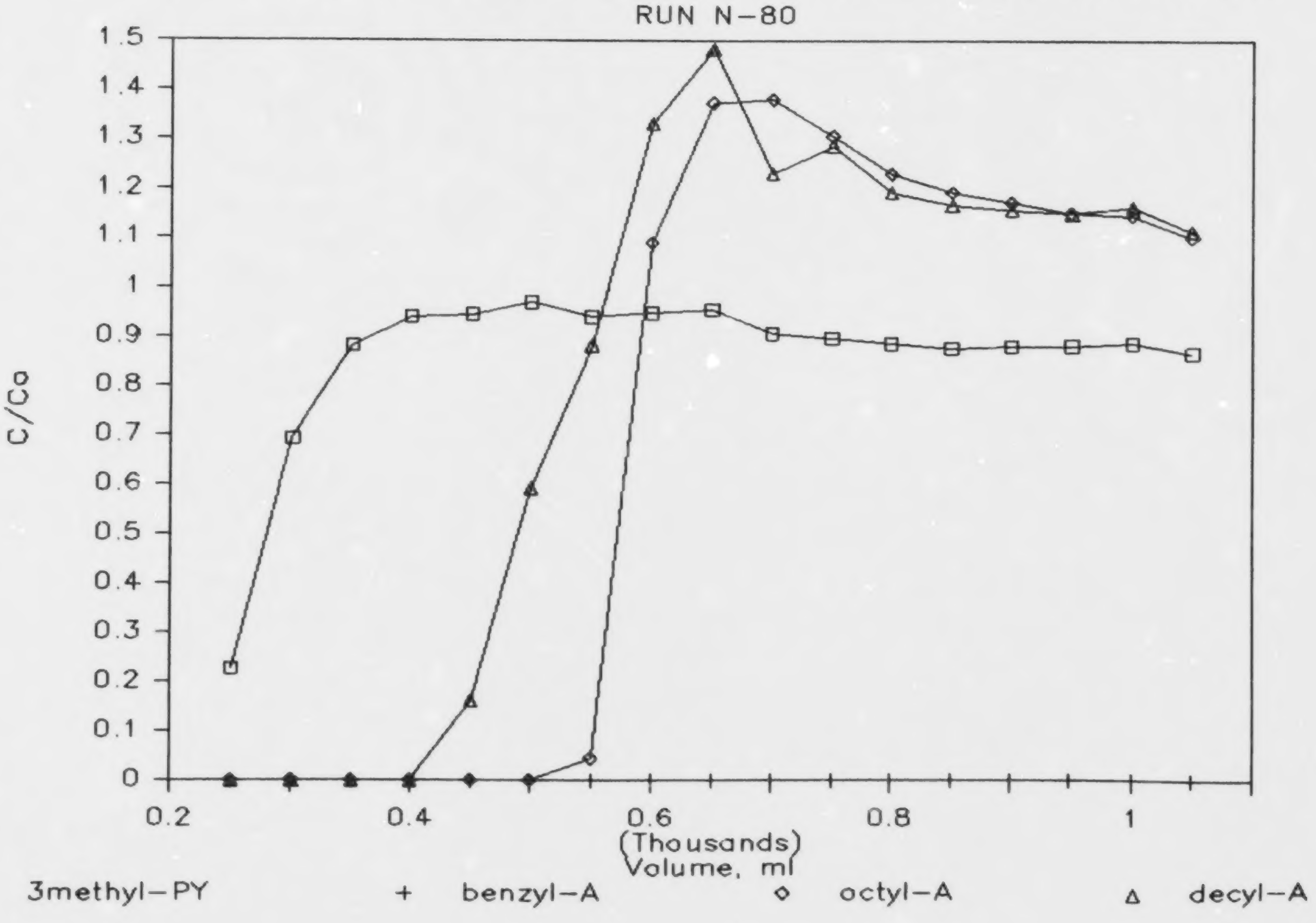

N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-80
C/Co
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.2
0.4
0.6
0.8
1
(Thousands)
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

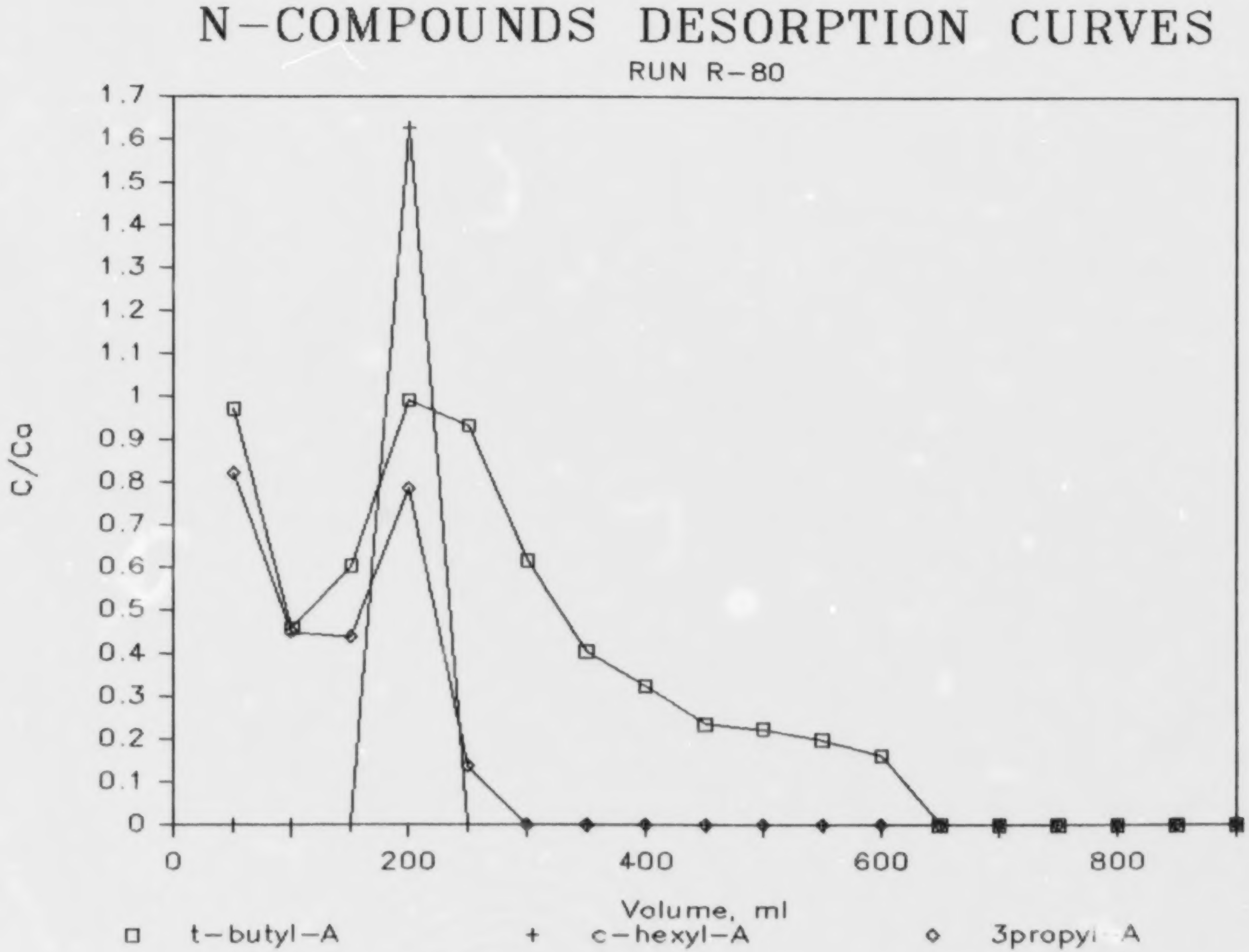
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-80



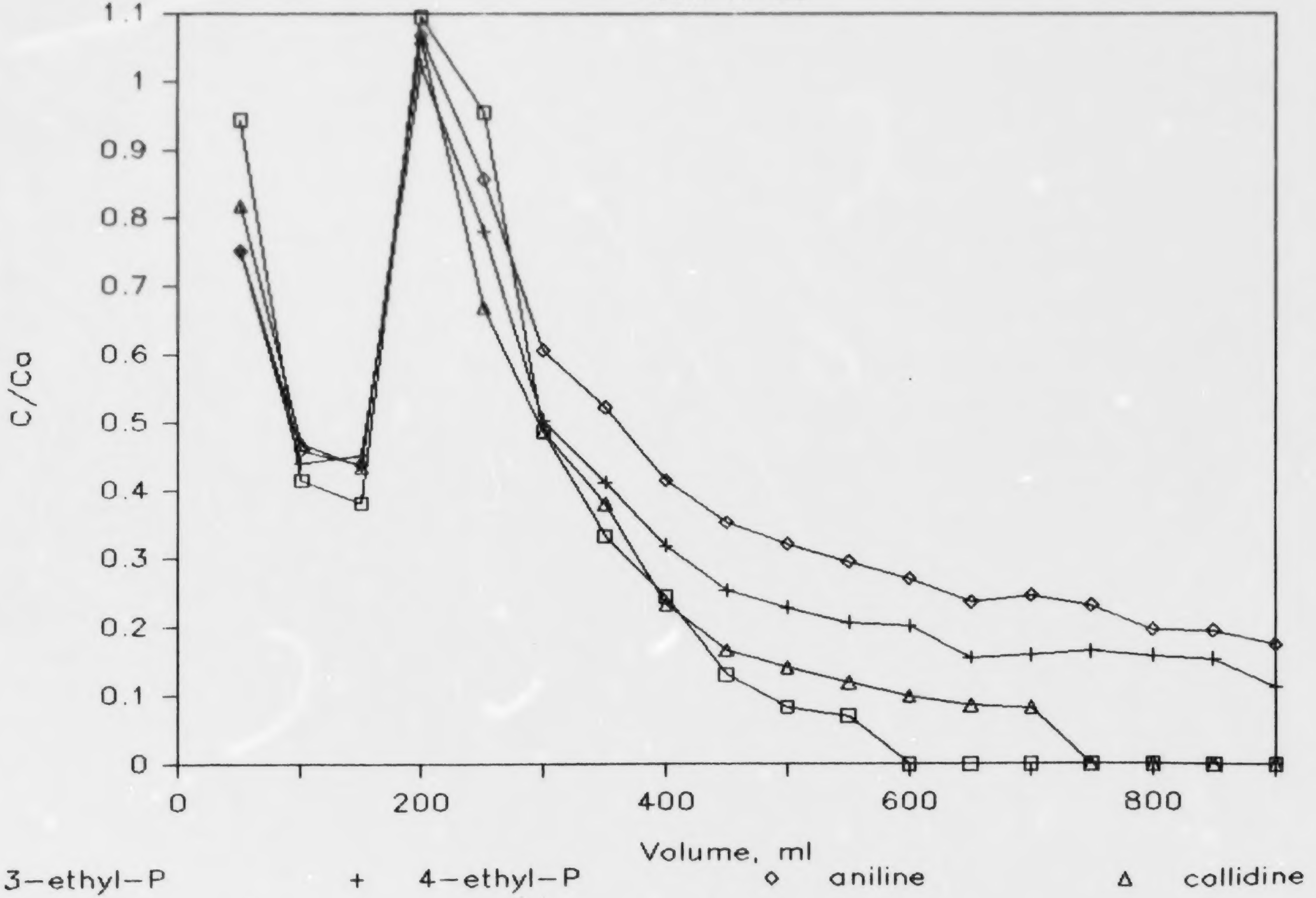
N-COMPOUNDS BREAKTHROUGH CURVES




N-COMPOUNDS DESORPTION CURVES
RUN R-80
C/Co
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
200
400
600
800
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

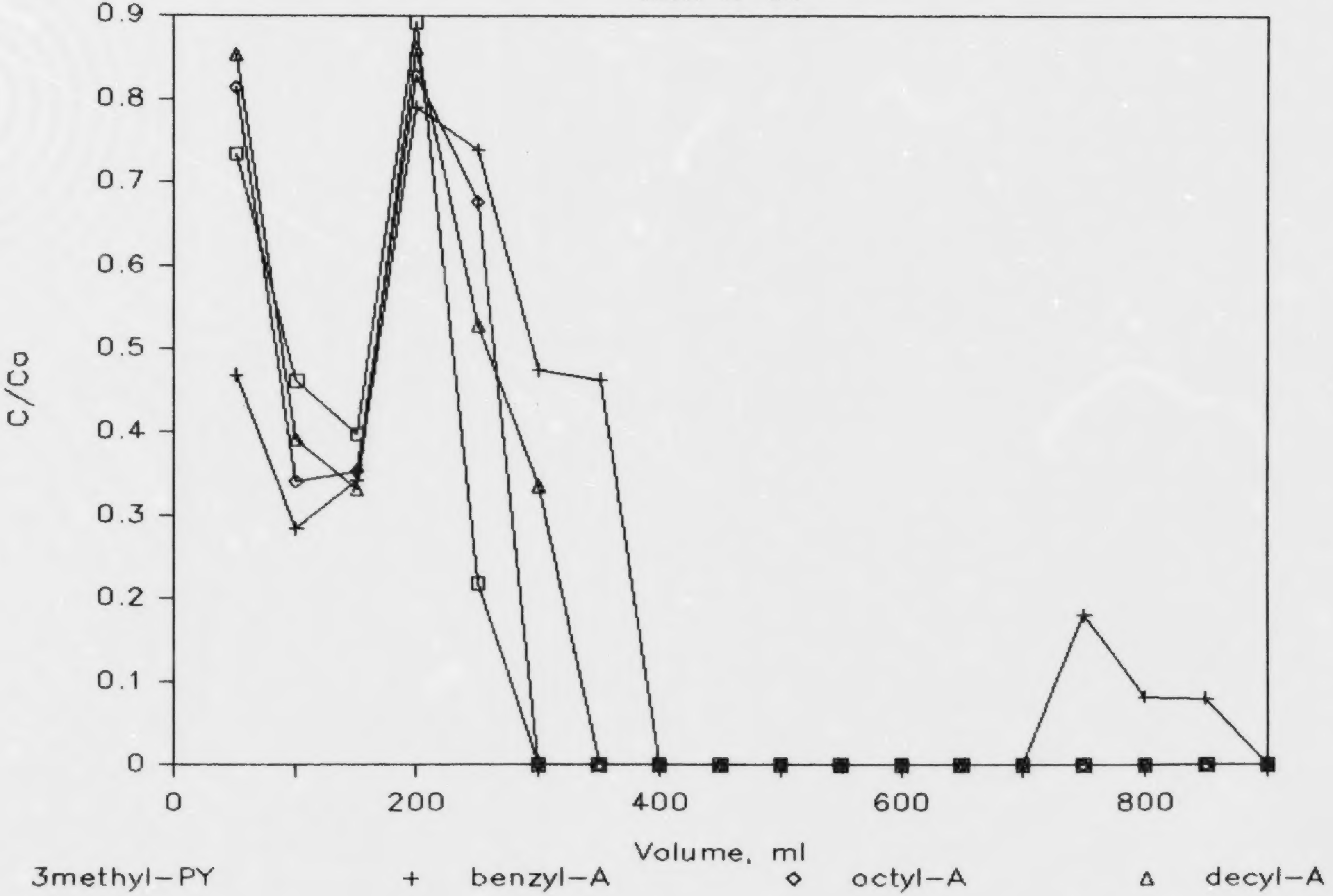
N-COMPOUNDS DESORPTION CURVES

RUN R-80



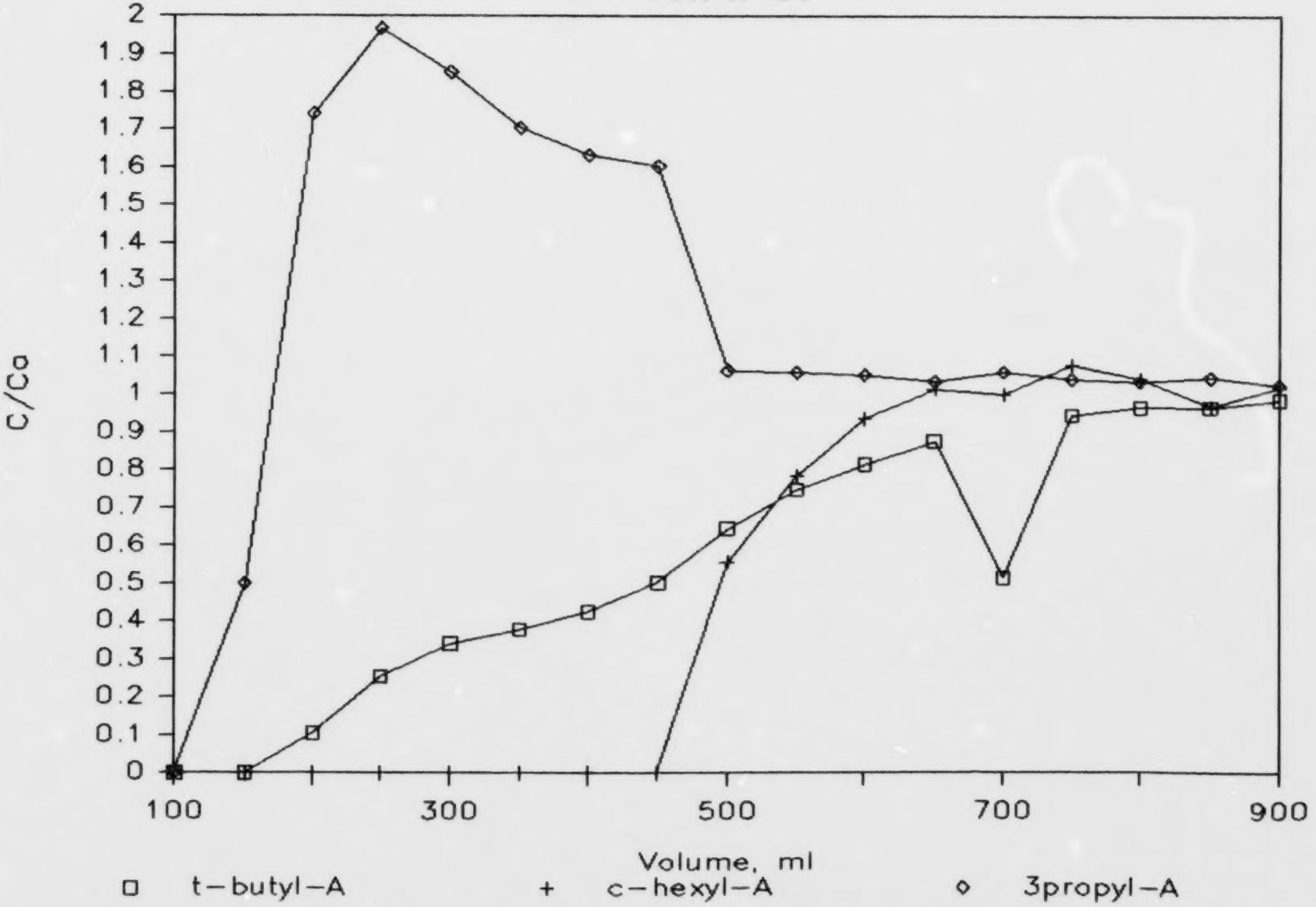
N-COMPOUNDS DESORPTION CURVES

RUN R-80

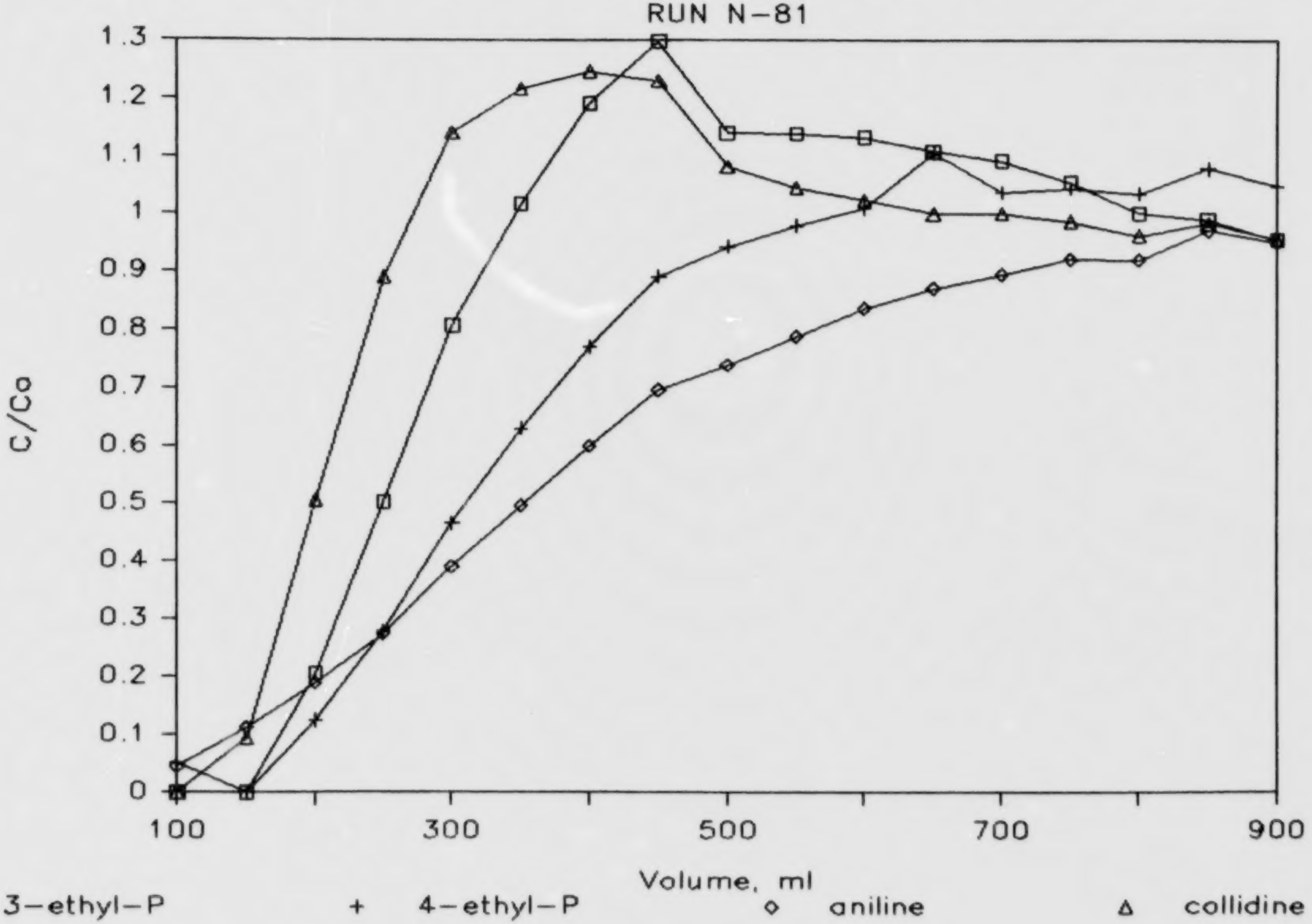


N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-81

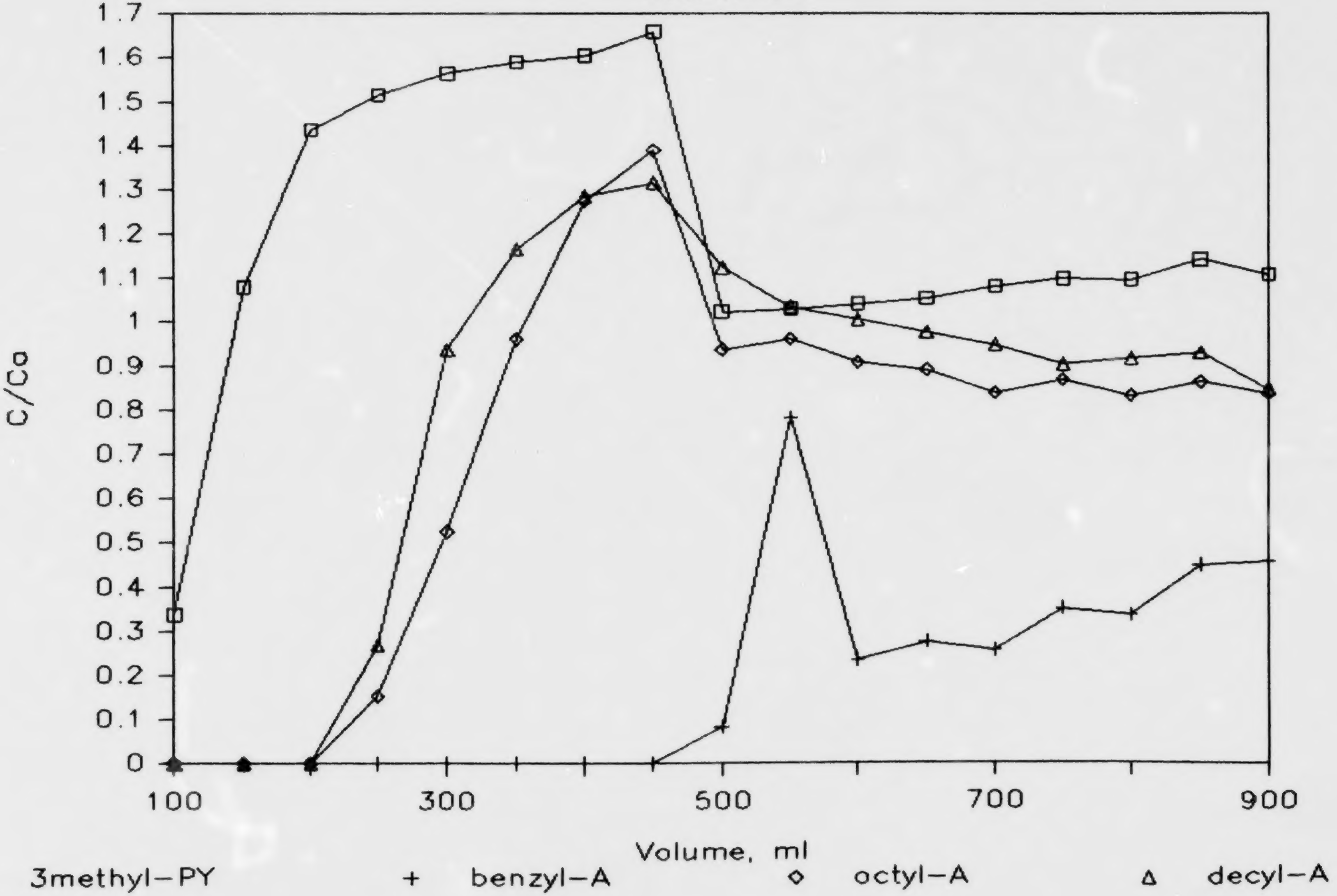


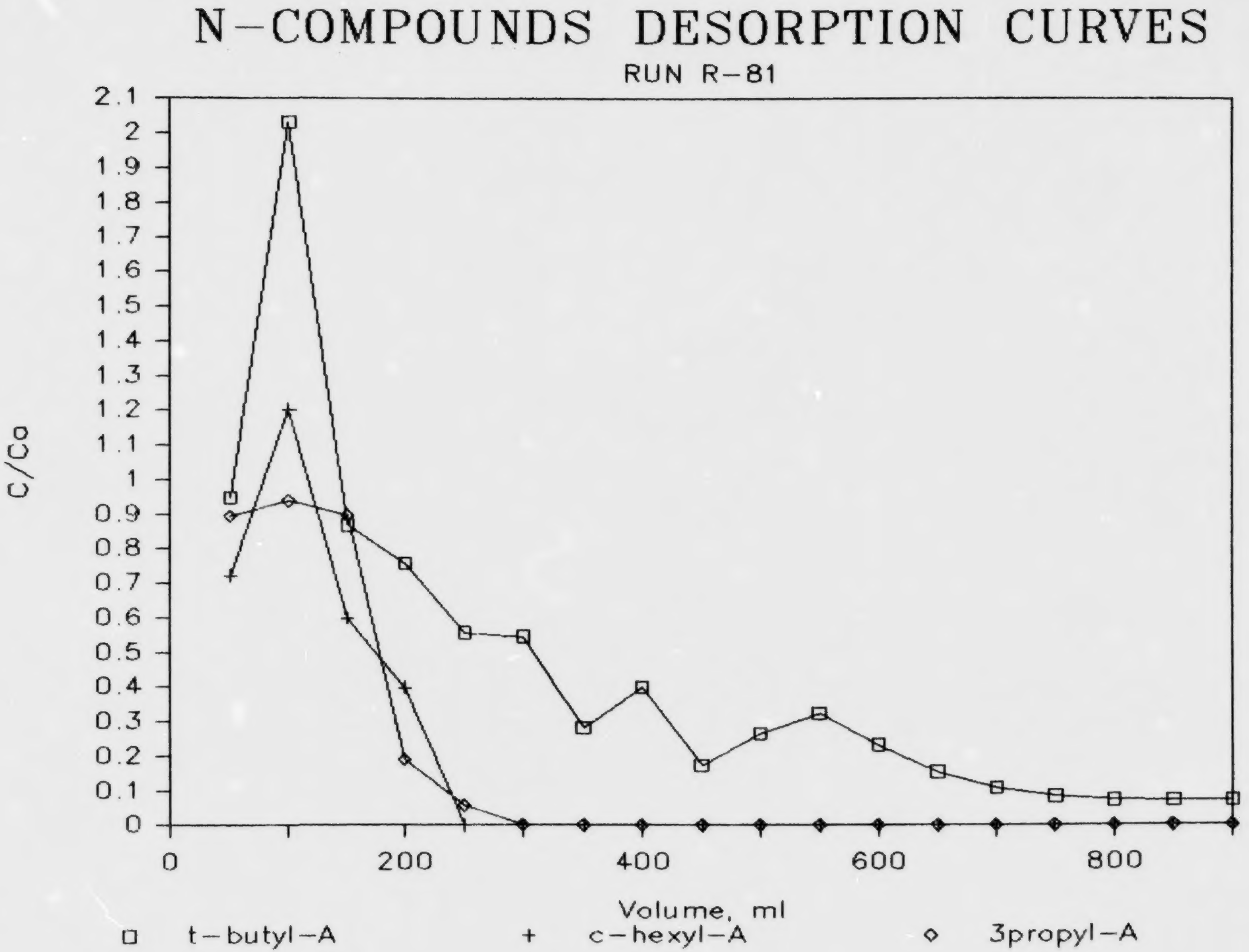
N-COMPOUNDS BREAKTHROUGH CURVES



N-COMPOUNDS BREAKTHROUGH CURVES

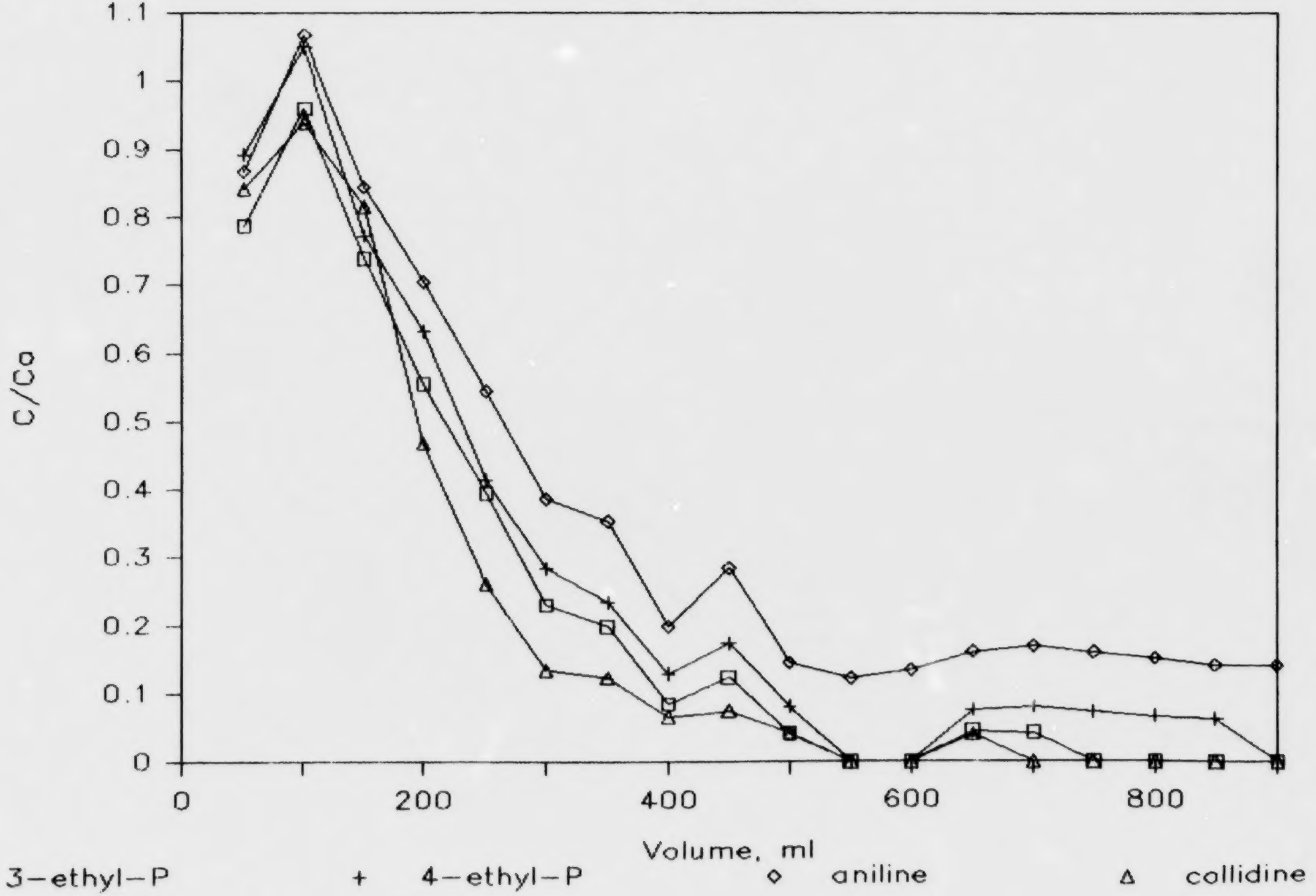
RUN N-81




N-COMPOUNDS DESORPTION CURVES
RUN R-81
C/Co
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
200
400
600
800
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

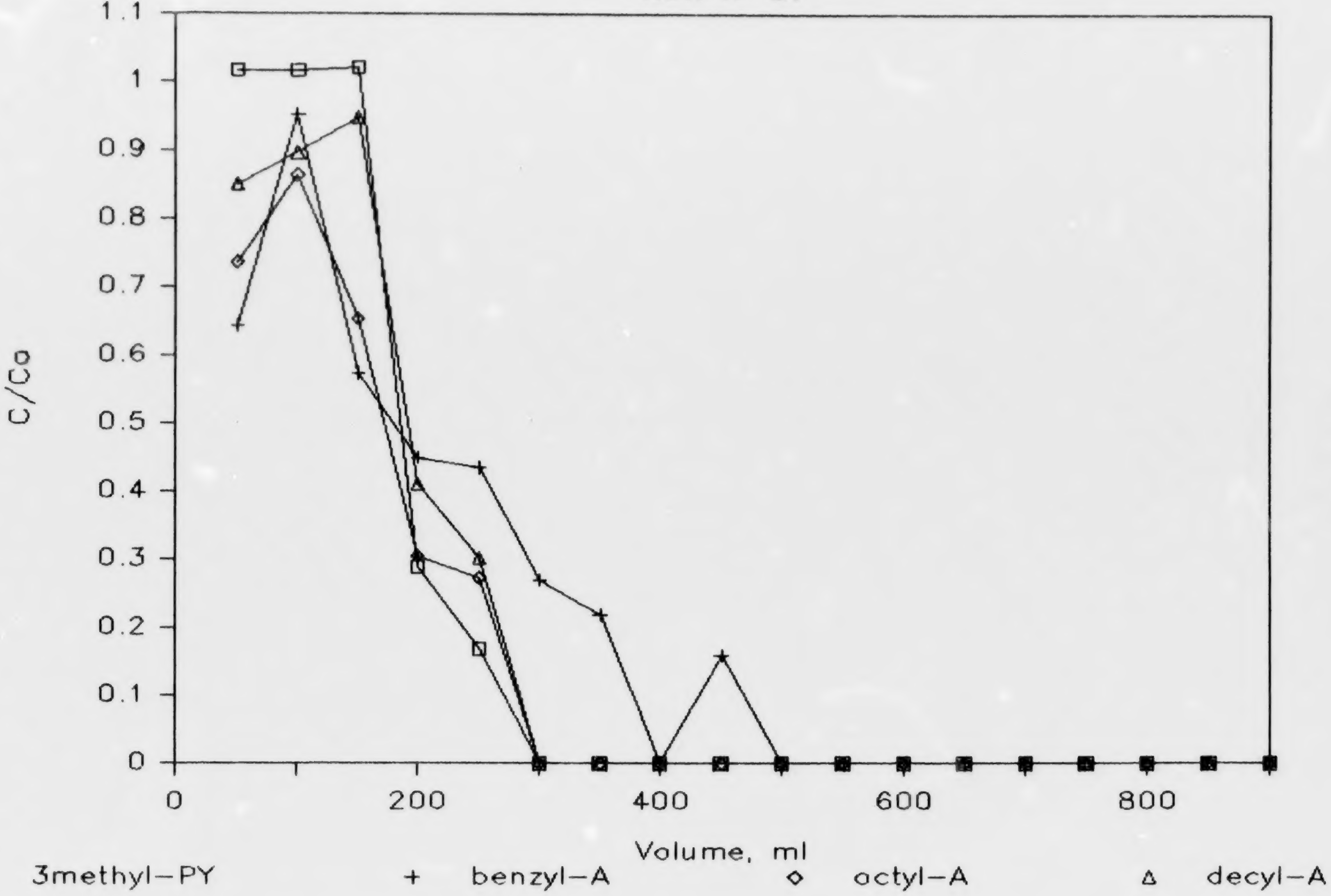
N-COMPOUNDS DESORPTION CURVES

RUN R-81



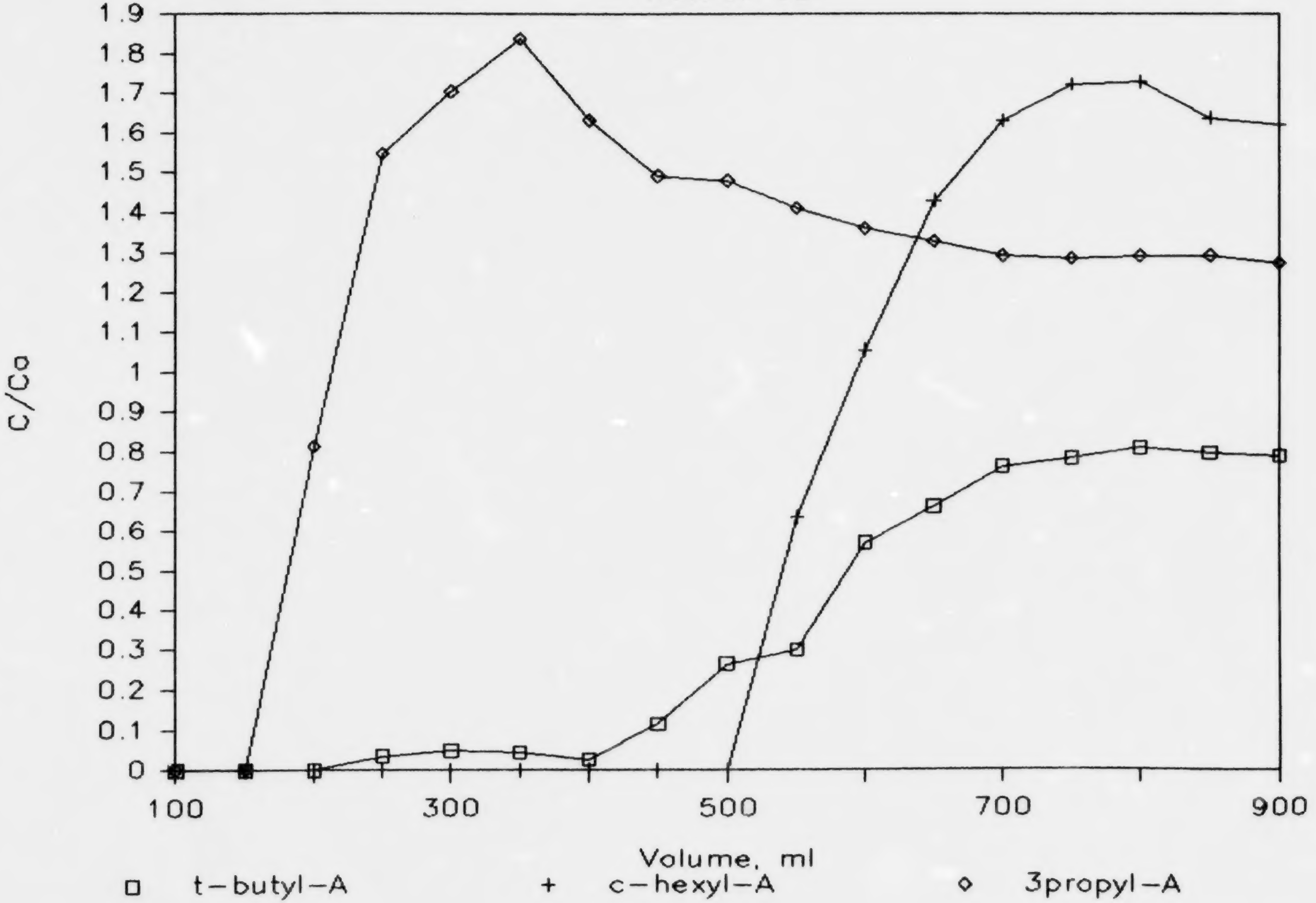
N-COMPOUNDS DESORPTION CURVES

RUN R-81



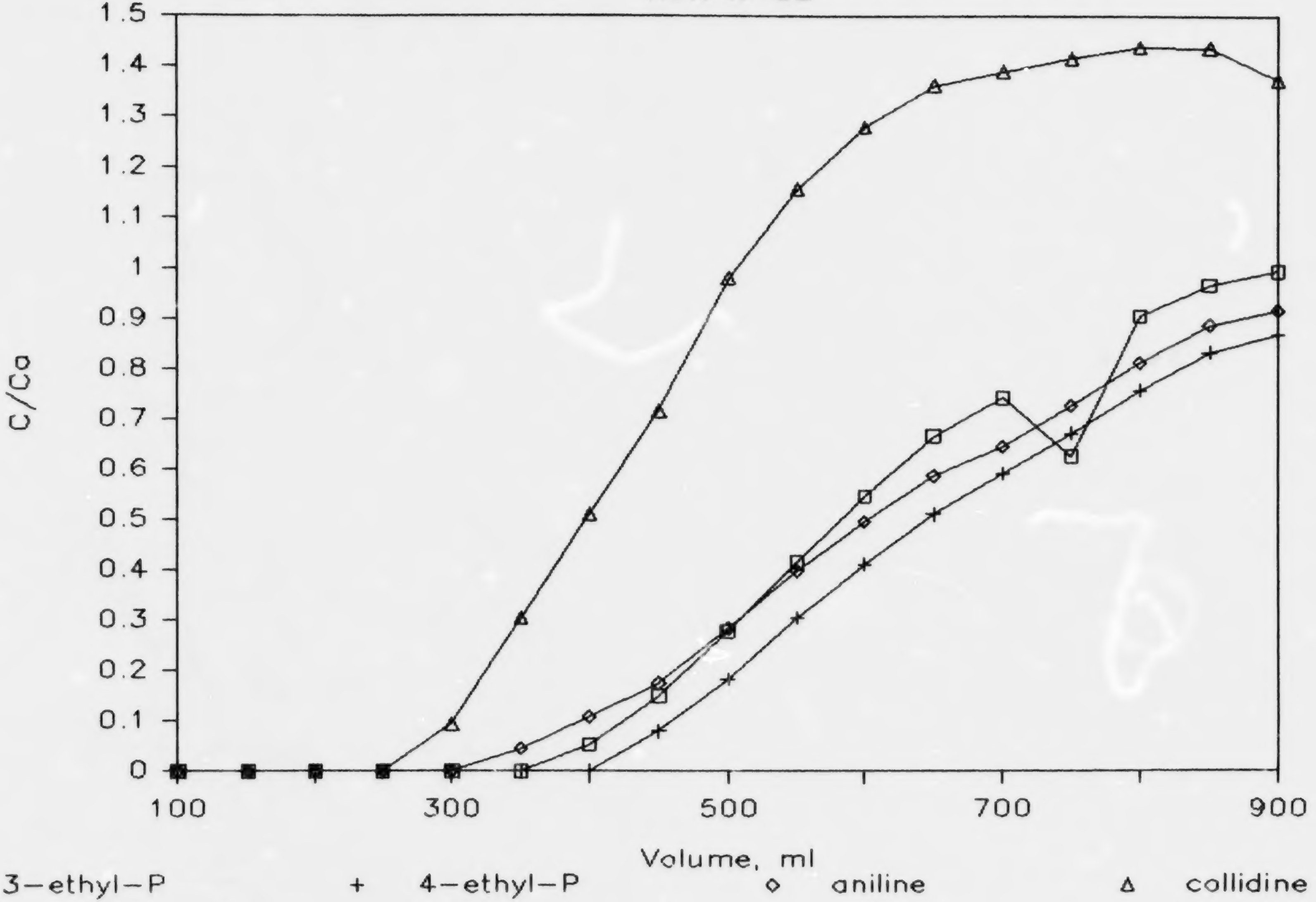
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-82



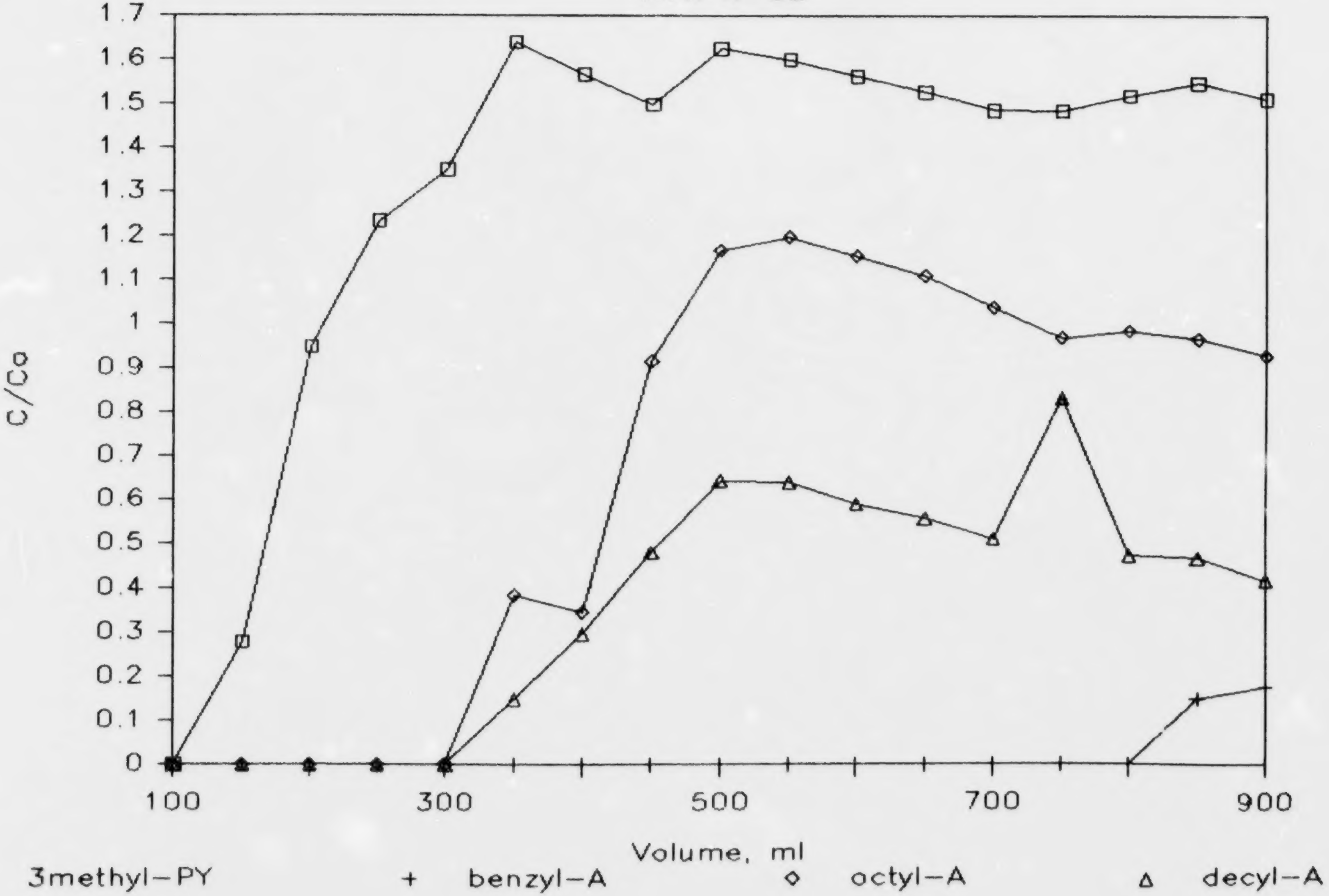
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–82



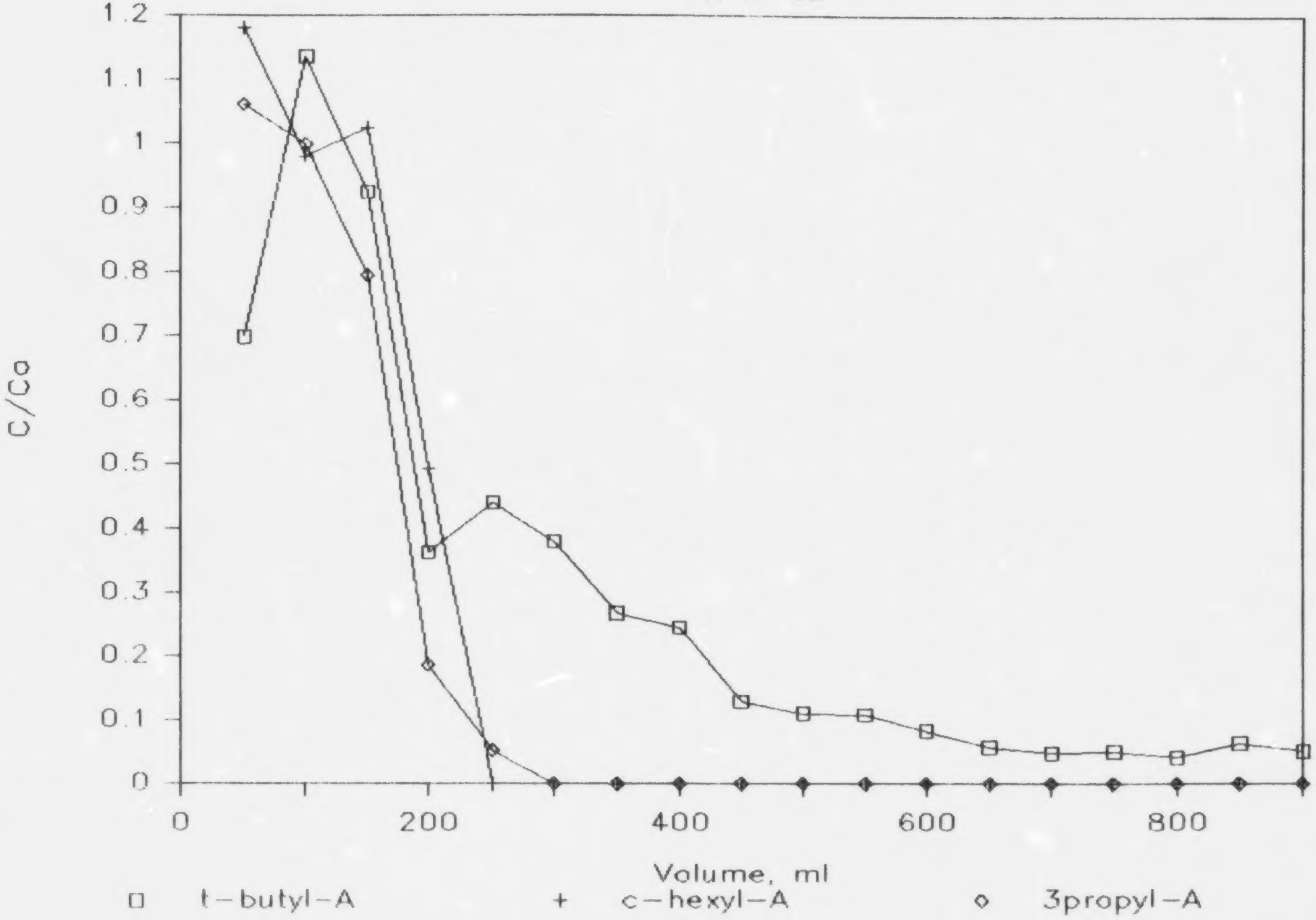
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–82



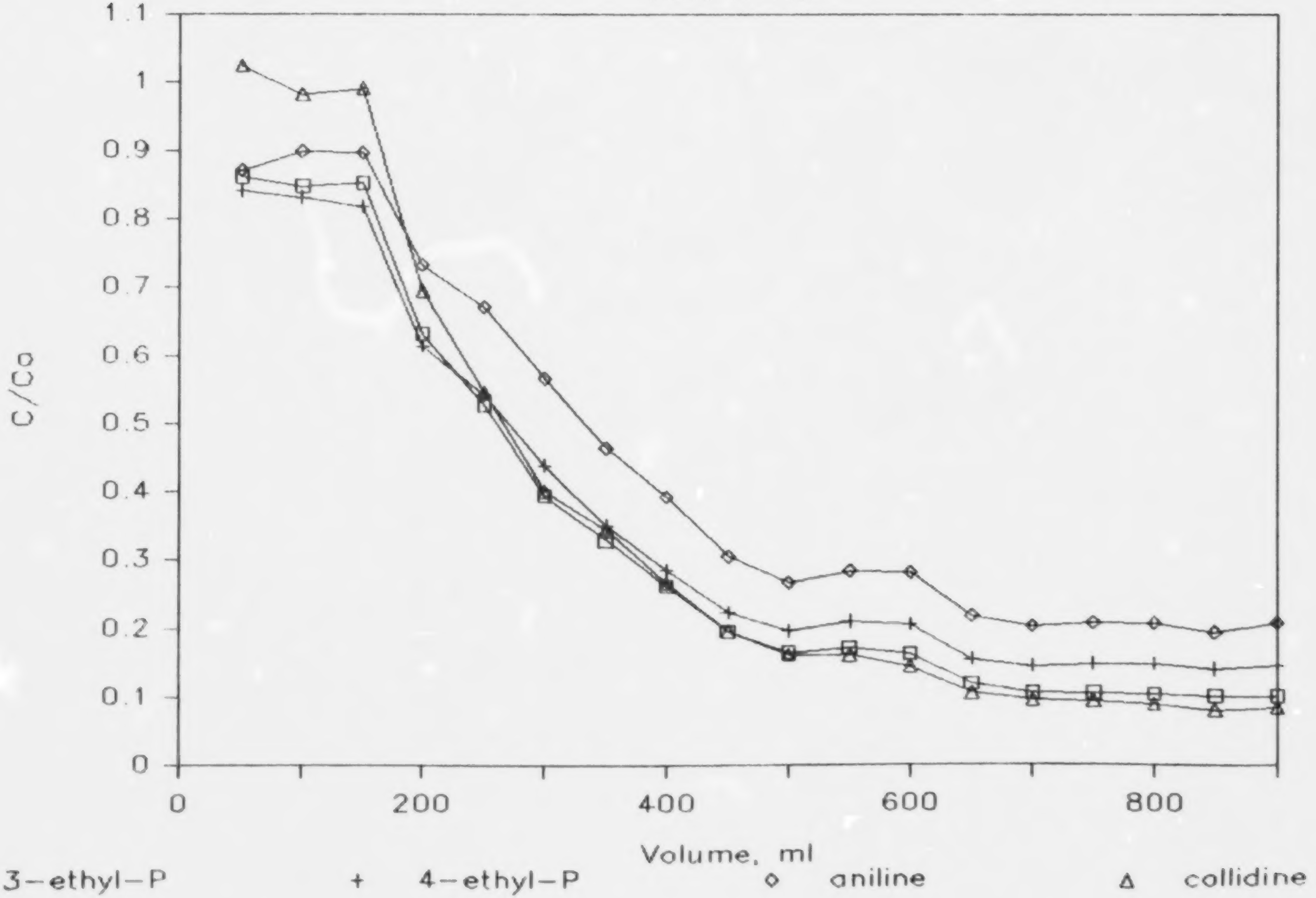
N-COMPOUNDS DESORPTION CURVES

RUN R-82



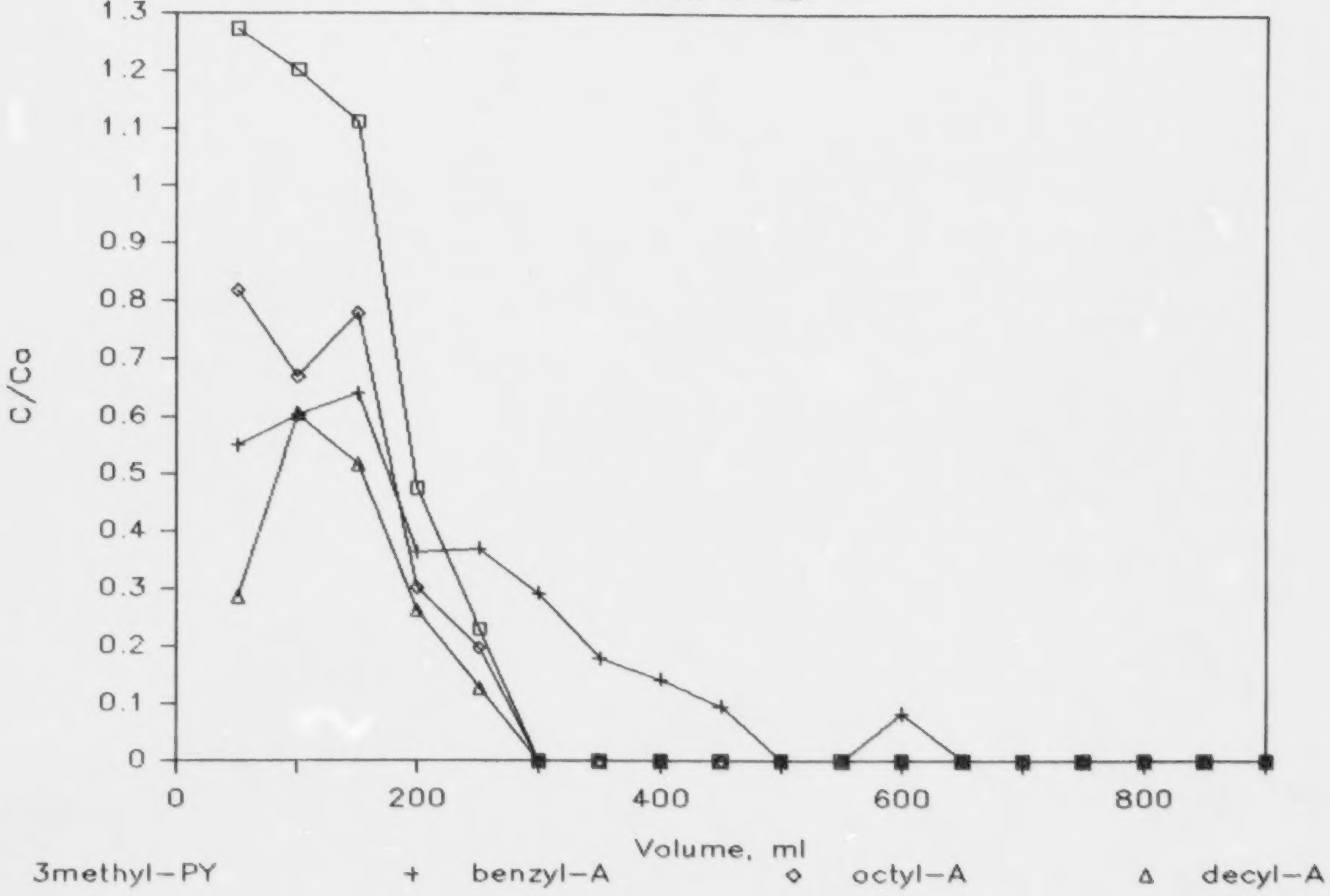
N-COMPOUNDS DESORPTION CURVES

RUN R-82



N-COMPOUNDS DESORPTION CURVES

RUN R-82



Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	C/Co Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	5	0	0	0	0	0	0	0	0	0	0	0
2	10	0	0	0	0	0	0	0	0	0	0	0
3	15	0	0	0	0	0	0	0	0	0	0	0
4	20	0	0	0	0	0	0	0	0	0	0	0
5	25	0	0	0	0	0	0	0	0	0	0	0
6	30	0	0	0	0	0	0	0	0	0	0	0
7	35	0	0	0	0	0	0	0	0	0	0	0
8	40	0	0	0	0	0	0	0	0	0	0	0
9	45	0	0	0	0	0	0	0	0	0	0	0
10	50	0	0	0	0	0	0	0	0	0	0	0
11	55	0	0	0	0	0	0	0	0	0	0	0
12	60	0	0	0	0	0	0	0	0	0	0	0
13	65	0	0	0	0	0	0	0	0	0	0	0
14	70	0	0	0	0	0	0	0	0	0	0	0
15	75	0	0	0	0	0	0	0	0	0	0	0
16	80	0	0	0	0	0	0	0	0	0	0	0
17	85	0	0	0	0	0	0	0	0	0	0	0
18	90	0	0	0	0	0	0	0	0	0	0	0
19	95	0	0	0	0	0	0	0	0	0	0	0
20	100	0	0	0	0	0	0	0	0	0	0	0
21	105	0	0	0	0	0	0	0	0	0	0	0
22	110	0	0	0	0	0	0	0	0	0	0	0
23	115	0	0	0	0	0	0	0	0	0	0	0
24	120	0	0	0	0	0	0	0	0	0	0	0
25	125	0	0	0	0	0	0	0	0	0	0	0
26	130	0	0	0	0	0	0	0	0	0	0	0
27	135	0	0	0	0	0	0	0	0	0	0	0
28	140	0	0	0	0	0	0	0	0	0	0	0
29	145	0	0	0	0	0	0	0	0	0	0	0
30	150	0	0	0	0	0	0	0	0	0	0	0
31	155	0	0	0	0	0	0	0	0	0	0	0
32	160	0	0	0	0	0	0	0	0	0	0	0
33	165	0	0	0	0	0	0	0	0	0	0	0
34	170	0	0	0	0	0	0	0	0	0	0	0
35	175	0	0	0	0	0	0	0	0	0	0	0
36	180	0	0	0	0	0	0	0	0	0	0	0
37	185	0	0	0	0	0	0	0	0	0	0	0
38	190	0	0	0	0	0	0	0	0	0	0	0
39	195	0	0	0	0	0	0	0	0	0	0	0
40	200	0	0	0	0	0	0	0	0	0	0	0
41	205	0	0	0	0	0	0	0	0	0	0	0
42	210	0	0	0	0	0	0	0	0	0	0	0
43	215	0	0	0	0	0	0	0	0	0	0	0
44	220	0	0	0	0	0	0	0	0	0	0	0
45	225	0	0	0	0	0	0	0	0	0	0	0
46	230	0	0	0	0	0	0	0	0	0	0	0
47	235	0	0	0	0	0	0	0	0	0	0	0
48	240	0	0	0	0	0	0	0	0	0	0	0

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

						C/Co						
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
49	245	0	0	0	0	0	0	0	0	0	0	0
50	250	0	0	0	0	0	0	0	0	0	0	0
51	255	0	0	0	0	0	0	0	0	0	0	0
52	260	0	0	0	0	0	0	0	0	0	0	0
53	265	0	0	0	0	0	0	0	0	0	0	0
54	270	0	0	0	0	0	0	0	0	0	0	0
55	275	0	0	0	0	0	0	0	0	0	0	0
56	280	0	0	0	0	0	0	0	0	0	0	0
57	285	0	0	0	0	0	0	0	0	0	0	0
58	290	0	0	0	0	0	0	0	0	0	0	0
59	295	0	0	0	0	0	0	0	0	0	0	0
60	300	0	0	0	0	0	0	0	0	0	0	0
61	305	0	0	0	0	0	0	0	0	0	0	0
62	310	0	0	0	0	0	0	0	0	0	0	0
63	315	0	0	0	0	0	0	0	0	0	0	0
64	320	0	0	0	0	0	0	0	0	0	0	0
65	325	0	0	0	0	0	0	0	0	0	0	0
66	330	0	0	0	0	0	0	0	0	0	0	0
67	335	0	0	0	0	0	0	0	0	0	0	0
68	340	0	0	0	0	0	0	0	0	0	0	0
69	345	0	0	0	0	0	0	0	0	0	0	0
70	350	0	0	0	0.00840268	0	0	0	0	0	0	0
71	355	0	0	0	0.00619429	0	0	0.01808970	0	0	0	0
72	360	0	0	0	0.00787373	0	0	0.01853085	0	0	0	0
73	365	0	0	0	0.00619040	0	0	0.01434514	0	0	0	0
74	370	0	0	0	0.00652253	0	0	0.01653669	0	0	0	0
75	375	0	0	0	0.00769334	0	0	0.02098746	0	0	0	0
76	380	0	0	0	0.01495725	0	0	0.01644951	0	0	0	0
77	385	0.04905400	0	0	0	0	0	0.00994104	0	0	0	0
78	390	0.12841915	0	0	0	0	0	0.01370200	0	0	0	0
79	395	0.18538452	0	0	0	0	0	0.01570347	0	0	0	0
80	400	0.19522504	0	0	0	0	0	0.01346354	0	0	0	0
81	405	0.23425703	0	0	0	0	0	0.01646166	0	0	0	0
82	410	0.24457493	0	0.01594026	0	0	0	0.01492281	0	0	0	0
83	415	0.29296603	0	0.04174169	0	0	0	0.01294873	0	0	0	0
84	420	0.24831844	0	0.06529324	0	0	0	0.01074704	0	0	0	0
85	425	0.44476065	0	0.16803375	0	0	0	0.01324335	0	0	0	0
86	430	0.40875899	0	0.29414135	0.02754612	0	0	0.01969072	0	0	0	0
87	435	0.32741447	0	0.40098671	0.03924512	0.01296404	0	0.02756898	0	0	0	0
88	440	0.26844646	0	0.39782558	0.03297986	0.01420228	0	0.01774999	0.01381794	0	0	0
89	445	0.22492236	0	0.49480252	0.04483261	0.01976696	0	0.02579662	0.01921962	0	0	0
90	450	0.21407947	0	0.47427645	0.04611427	0.02113893	0	0.02397080	0.02120318	0	0	0
91	455	0.17097624	0	0.50400312	0.05188737	0.02610033	0	0.02356757	0.02205043	0	0	0
92	460	0.15657283	0	0.48789092	0.05485735	0.02859591	0	0.02368753	0.02612043	0	0	0
93	465	0.20720980	0	0.44892155	0.05476157	0.02983722	0	0.01910619	0.02660732	0	0	0
94	470	0.21582300	0	0.48622207	0.06223517	0.03704391	0	0.01906548	0.03454350	0	0	0
95	475	0.14520817	0	0.52528771	0.08206351	0.04316675	0	0.04837527	0.04692908	0	0	0.05686333
96	480	0.15870320	0	0.45070459	0.07086993	0.03955560	0	0.03158575	0.04090196	0	0	0.04587139

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
97	485	0.10910830	0	0.41664872	0.06710390	0.04015743	0	0.02326643	0.04284032	0	0	0.06057247
98	490	0.12088752	0	0.43322490	0.07151713	0.04354085	0	0.02132317	0.04539388	0	0	0.05032774
99	495	0.15300085	0	0.39562369	0.06610936	0.04159471	0	0.01684190	0.04400550	0	0	0.04544799
100	500	0.14823427	0	0.48827033	0.08632622	0.05250412	0	0.02749519	0.05939652	0	0	0.08589228
101	505	0.11413593	0	0.39707731	0.07326176	0.04538620	0	0.02225043	0.05231565	0	0	0.09649926
102	510	0.17224845	0	0.52374101	0.09607971	0.05992588	0	0.02264135	0.07052287	0	0.12588459	0.11039138

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

#	ml	Toluene-S	Toluene-F
1	5	0	982339
2	10	0	
3	15	0	
4	20	0	
5	25	0	
6	30	0	
7	35	0	
8	40	0	
9	45	0	
10	50	0	
11	55	0	
12	60	0	
13	65	0	
14	70	0	
15	75	0	
16	80	0	
17	85	0	
18	90	0	
19	95	0	
20	100	0	
21	105	0	
22	110	0	
23	115	0	
24	120	0	
25	125	0	
26	130	0	
27	135	0	
28	140	0	
29	145	0	
30	150	0	
31	155	0	
32	160	0	
33	165	0	
34	170	0	
35	175	0	
36	180	0	
37	185	0	
38	190	0	
39	195	0	
40	200	0	
41	205	0	
42	210	0	
43	215	0	
44	220	0	
45	225	0	
46	230	0	
47	235	0	
48	240	0	

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

#	ml	Toluene-S	Toluene-F
49	245	0	
50	250	0	
51	255	0	
52	260	0	
53	265	0	
54	270	0	
55	275	0	
56	280	0	
57	285	0	
58	290	0	
59	295	0	
60	300	0	
61	305	0	
62	310	0	
63	315	0	
64	320	0	
65	325	0	
66	330	0	
67	335	0	
68	340	0	
69	345	0	
70	350	1002660	
71	355	808395	
72	360	814868	
73	365	776031	
74	370	741382	
75	375	800752	
76	380	695633	
77	385	540060	
78	390	758918	
79	395	725294	
80	400	650145	
81	405	643663	
82	410	582894	
83	415	633642	
84	420	477375	
85	425	761010	
86	430	805078	
87	435	780628	
88	440	729839	
89	445	724139	
90	450	720445	
91	455	726007	
92	460	722556	
93	465	781530	
94	470	805750	
95	475	704688	
96	480	727293	

Run N-22: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 250 ppm

#	ml	Toluene-S	Toluene-F
97	485	649395	
98	490	720542	
99	495	715882	
100	500	795296	
101	505	644706	
102	510	909609	

Run N-23: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	5	0	0	0	0	0	0	0	0	0	0	0
2	10	0	0	0	0	0	0	0	0	0	0	0
3	15	0	0	0	0	0	0	0	0	0	0	0
4	20	0	0	0	0	0	0	0	0	0	0	0
5	25	0	0	0	0	0	0	0	0	0	0	0
6	30	0	0	0	0	0	0	0	0	0	0	0
7	35	0	0	0	0	0	0	0	0	0	0	0
8	40	0	0	0	0	0	0	0	0	0	0	0
9	45	0	0	0	0	0	0	0	0	0	0	0
10	50	0	0	0	0	0	0	0	0	0	0	0
11	55	0	0	0	0	0	0	0	0	0	0	0
12	60	0	0	0	0	0	0	0	0	0	0	0
13	65	0	0	0	0	0	0	0	0	0	0	0
14	70	0	0	0	0	0	0	0	0	0	0	0
15	75	0	0	0	0	0	0	0	0	0	0	0
16	80	0	0	0	0	0	0	0	0	0	0	0
17	85	0	0	0	0	0	0	0	0	0	0	0
18	90	0	0	0	0	0	0	0	0	0	0	0
19	95	0	0	0	0	0	0	0	0	0	0	0
20	100	0	0	0	0	0	0	0	0	0	0	0
21	105	0	0	0	0	0	0	0	0	0	0	0
22	110	0	0	0	0	0	0	0	0	0	0	0
23	115	0	0	0	0	0	0	0	0	0	0	0
24	120	0	0	0	0	0	0	0	0	0	0	0
25	125	0	0	0	0	0	0	0	0	0	0	0
26	130	0	0	0	0	0	0	0	0	0	0	0
27	135	0	0	0	0	0	0	0	0	0	0	0
28	140	0	0	0	0	0	0	0	0	0	0	0
29	145	0	0	0	0	0	0	0	0	0	0	0
30	150	0	0	0	0	0	0	0	0	0	0	0
31	155	0	0	0.06015297	0	0	0	0	0	0	0	0
32	160	0.00640943	0	0.48948613	0	0	0	0	0	0	0	0
33	165	0.02967693	0	1.20078995	0	0	0	0	0	0	0	0
34	170	0.23662527	0	1.34750526	0	0	0	0	0	0	0	0
35	175	0.18993741	0	1.78457551	0	0	0	0.00336972	0	0	0	0
36	180	0.23930736	0	1.76661080	0.00624571	0	0	0.00304660	0	0.00575207	0	0
37	185	0.29755864	0	1.73093688	0.01656573	0.00624035	0	0.00295326	0.00346621	0.00897494	0	0
38	190	0.38108684	0	1.25981652	0.03877994	0.01661766	0	0	0.01482558	0.00972763	0	0
39	195	0.47893461	0	1.45608181	0.10149032	0.04906486	0	0.00314859	0.06817784	0.01434256	0.05869863	0
40	200	0.56319890	0	1.47419013	0.17534751	0.09815317	0	0.00334684	0.19841452	0.01609441	0.20940194	0.04592426
41	205	0.42166125	0	1.46542193	0.24757589	0.16280500	0	0.00348573	0.47994289	0.01748414	0.62510421	0.17046783
42	210	0.44700773	0	1.15344498	0.20862975	0.15617160	0	0	0.64443790	0.01353758	0.86587593	0.26677964
43	215	0.43790856	0	1.19609300	0.19383578	0.15605348	0	0.00388312	0.88736417	0.00978400	1.18899748	0.34588823
44	220	0.35930425	0	0.96426797	0.13722910	0.10948068	0	0	0.81012005	0.00844701	1.12273079	0.34472053
45	225	0.36194991	0	0.90725688	0.11890068	0.09091368	0	0	0.80652620	0.00783249	1.0685685	0.34355002
46	230	0.36360925	0	0.85476407	0.10305960	0.07742147	0	0	0.77110185	0.00696473	0.98655119	0.36743107
47	235	0.32143136	0.02379707	0.77147887	0.08544408	0.06378808	0	0	0.69723397	0.00620604	0.84153171	0.35807404
48	240	0.58482230	0.08931344	0.97472265	0.09475436	0.07038366	0	0	0.83960924	0.00772420	0.98306879	0.48722980

Run N-23: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	5		728171
2	10		
3	15		
4	20		
5	25		
6	30		
7	35		
8	40		
9	45		
10	50		
11	55		
12	60		
13	65		
14	70		
15	75		
16	80		
17	85		
18	90		
19	95		
20	100		
21	105		
22	110		
23	115		
24	120		
25	125		
26	130		
27	135		
28	140		
29	145		
30	150		
31	155	845657	
32	160	835346	
33	165	760874	
34	170	705642	
35	175	813843	
36	180	822563	
37	185	846980	
38	190	655747	
39	195	760437	
40	200	853319	
41	205	841860	
42	210	769650	
43	215	809962	
44	220	752032	
45	225	724701	
46	230	683769	
47	235	585674	
48	240	775478	

Run N-39: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm (Repeat of Run N-23)

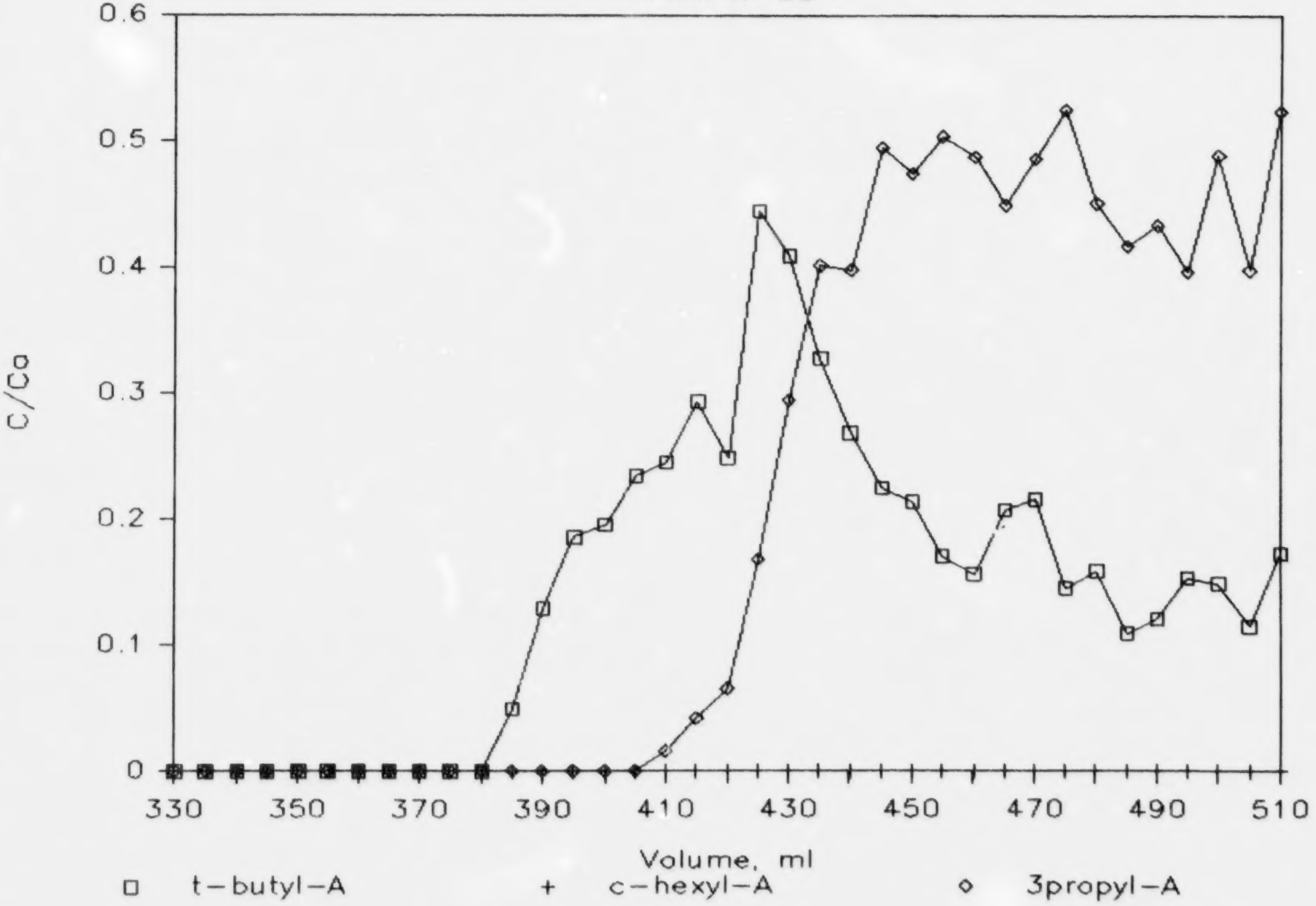
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0.05896387	0.11628277	0.06649521	1.15145322	1.10779657	0.76220746	1.38608067	0.31506419	0	0.01998023	0.67495162
5	50	0.01493854	0	0	0.05165198	0.06249910	0.05097044	0.09950415	0.03815824	0	0	0.05837013
6	60	0.01123942	0	0	0.04059639	0.04867878	0.07299812	0.10175629	0.03012684	0	0	0.03305532
7	70	0	0	0	0.01339275	0.02582834	0.04828497	0.04332298	0.01851302	0	0	0.02598811
8	80	0	0	0	0	0.01204938	0.02616684	0.02283973	0.00926462	0	0	0.01978381
9	90	0	0	0	0	0.01423247	0.03073336	0.02575748	0.01380105	0	0	0.03621689
10	100	0.00689911	0	0	0	0.01556685	0.03429016	0.02961326	0.01558540	0	0	0.02524586
11	110	0	0	0	0	0	0.01072763	0.00949320	0	0	0	0
12	120	0.00694257	0	0	0	0	0	0.00744865	0	0	0	0
13	130	0	0	0	0	0	0	0.00702881	0	0	0	0
14	140	0	0	0	0	0	0	0.00614882	0	0	0	0
15	150	0.11204639	0	0.12394722	0	0	0	0.00548568	0	0	0	0
16	160	0.30117290	0	0.91758825	0.00620833	0	0	0.00795392	0	0	0	0
17	170	0.24829157	0	1.07160704	0.00661778	0	0	0.00805320	0	0	0	0
18	180	0.33124452	0	1.48726250	0.02934780	0.01482068	0	0.00916046	0.00569993	0.00753798	0	0
19	190	0.24380859	0	1.36135269	0.07336824	0.04217460	0	0.00941347	0.03046784	0.01117369	0.02100801	0
20	200	0.18187614	0	1.27198134	0.19673389	0.12890512	0	0.01083712	0.17282270	0.01430442	0.27617916	0.05470747
21	210	0.12745253	0	1.04021574	0.21619103	0.15816736	0	0.01021024	0.38186067	0.01204810	0.79402239	0.22410709
22	220	0.13011408	0	1.05967423	0.19104655	0.14626389	0	0.01071936	0.52723648	0.01490889	1.18017469	0.47932039
23	230	0.16626095	0.06426594	0.98882347	0.16133938	0.11847507	0	0.00958514	0.57658556	0.00983722	1.07525419	0.48569116
24	240	0.12971785	0.37738070	1.42788873	0.23249234	0.16335231	0.03321510	0.03719503	1.03233254	0.01973407	1.75326316	1.06130460

Run N-39: 13X, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm (Repeat of Run N-23)

#	ml	Toluene-S	Toluene-F
1	10		584204
2	20		
3	30		
4	40	780667	
5	50	645309	
6	60	780844	
7	70	872349	
8	80	870446	
9	90	890603	
10	100	833262	
11	110	674610	
12	120	750394	
13	130	764525	
14	140	712449	
15	150	626296	
16	160	785051	
17	170	656167	
18	180	828546	
19	190	712633	
20	200	657025	
21	210	564801	
22	220	616975	
23	230	575270	
24	240	780233	

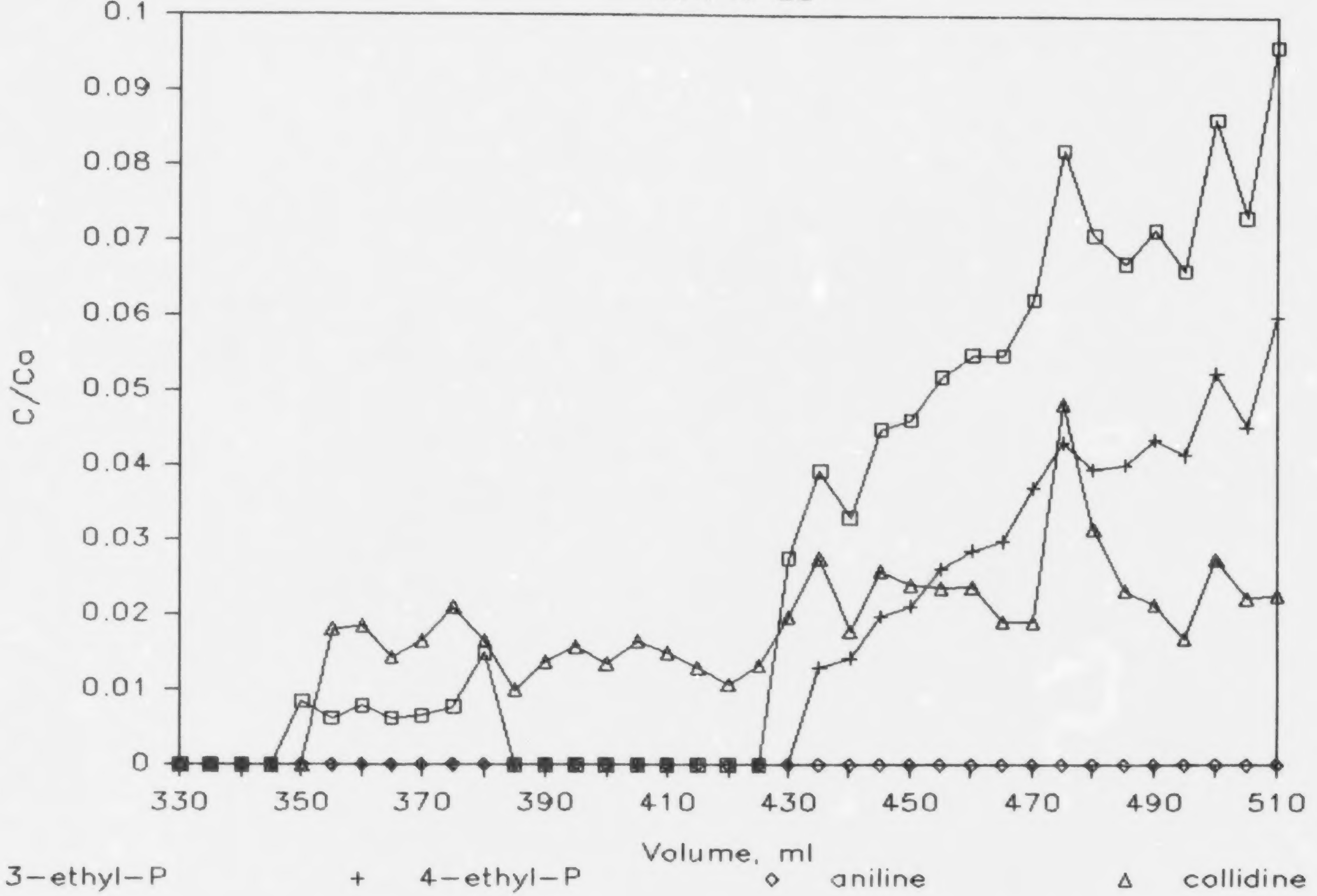
N−COMPOUNDS BREAKTHROUGH CURVES

RUN N−22



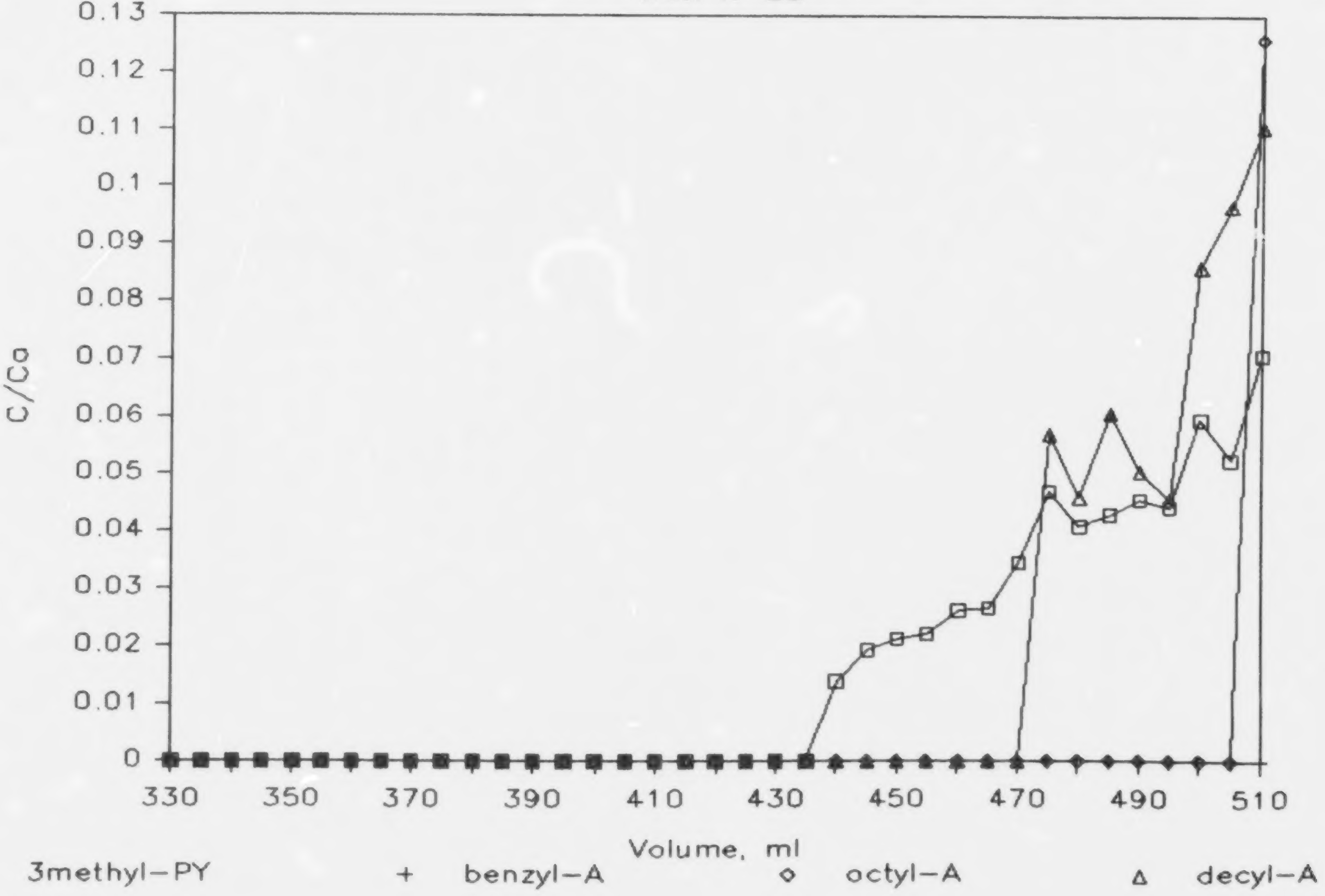
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-22



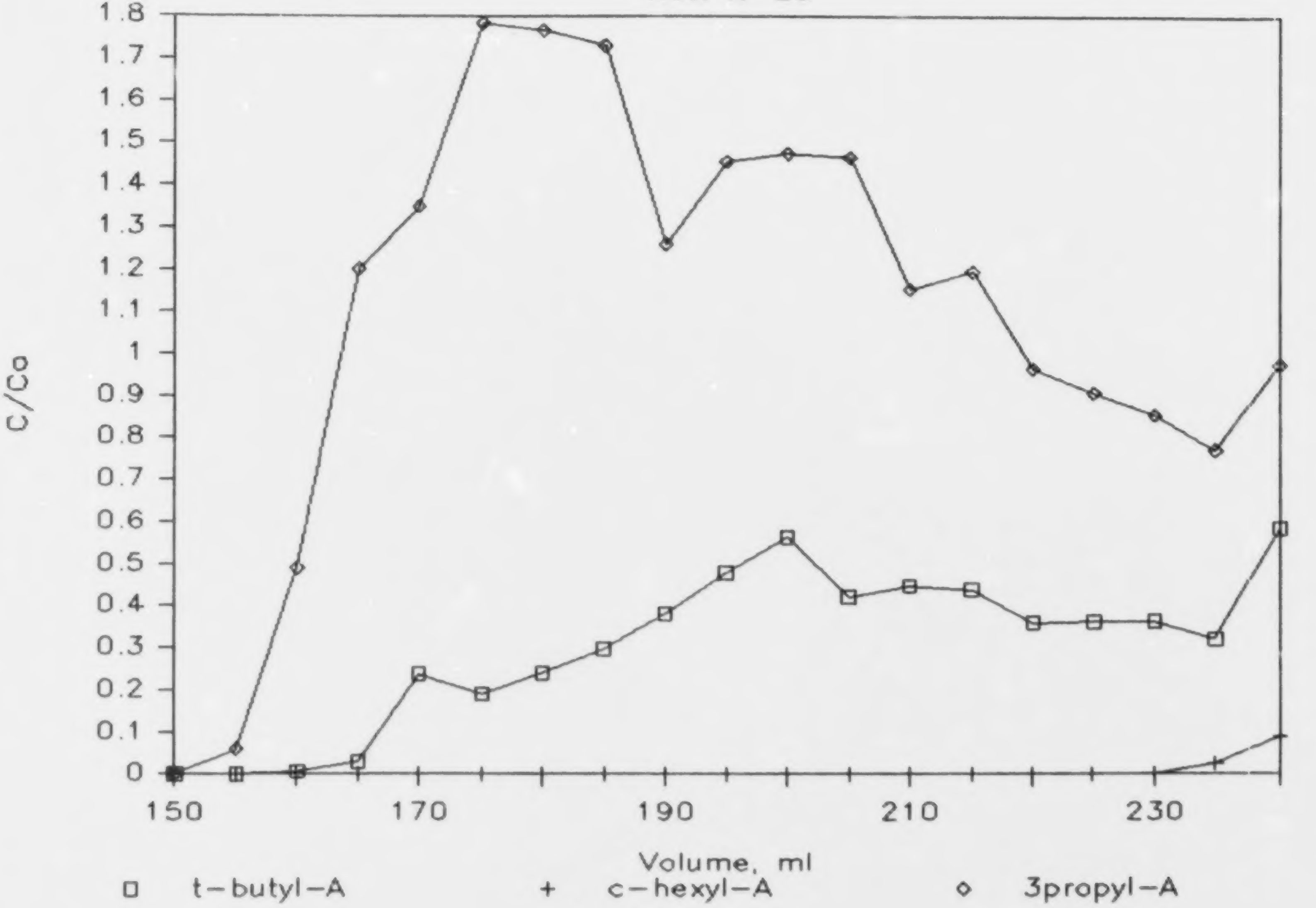
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-22



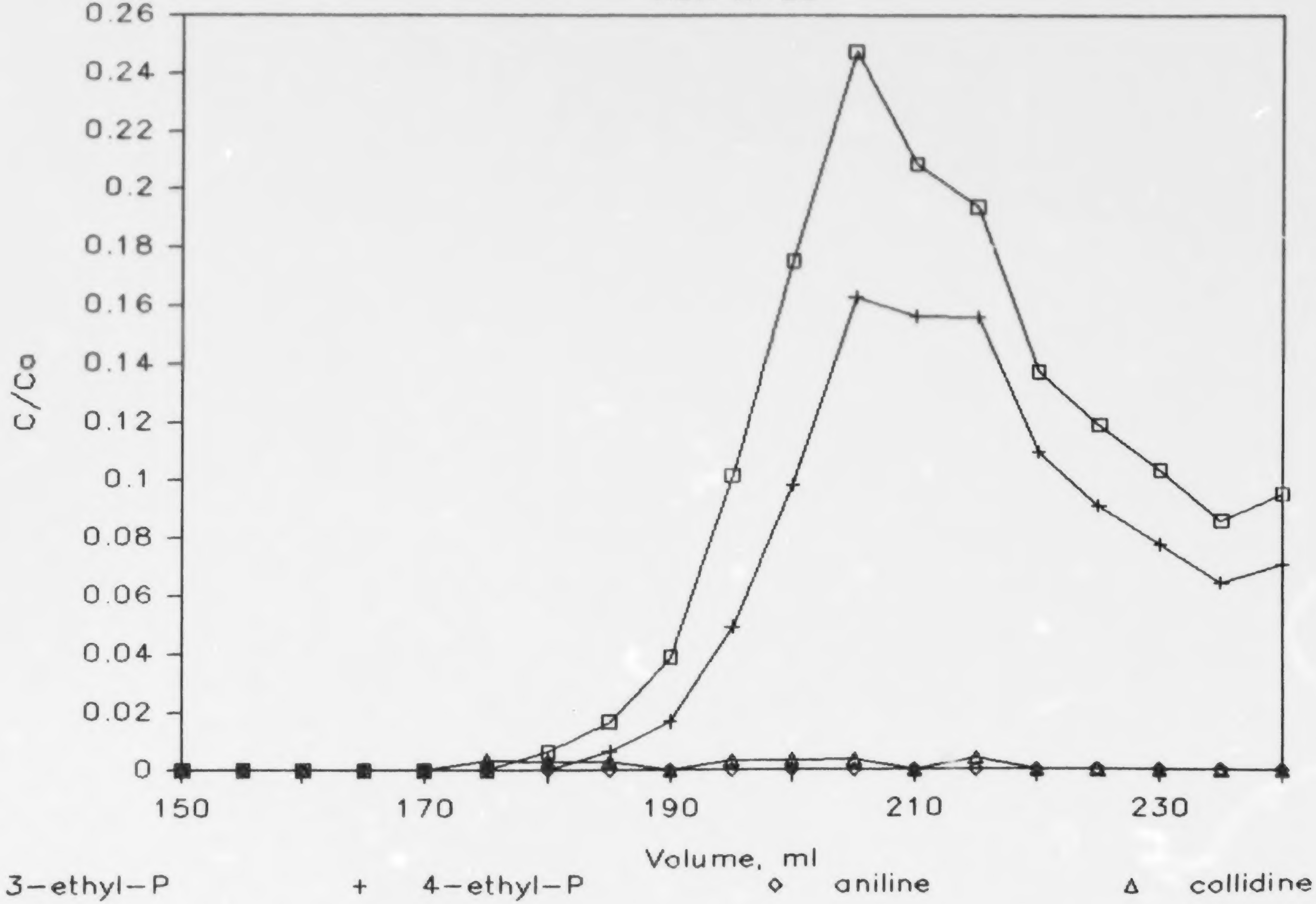
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–23



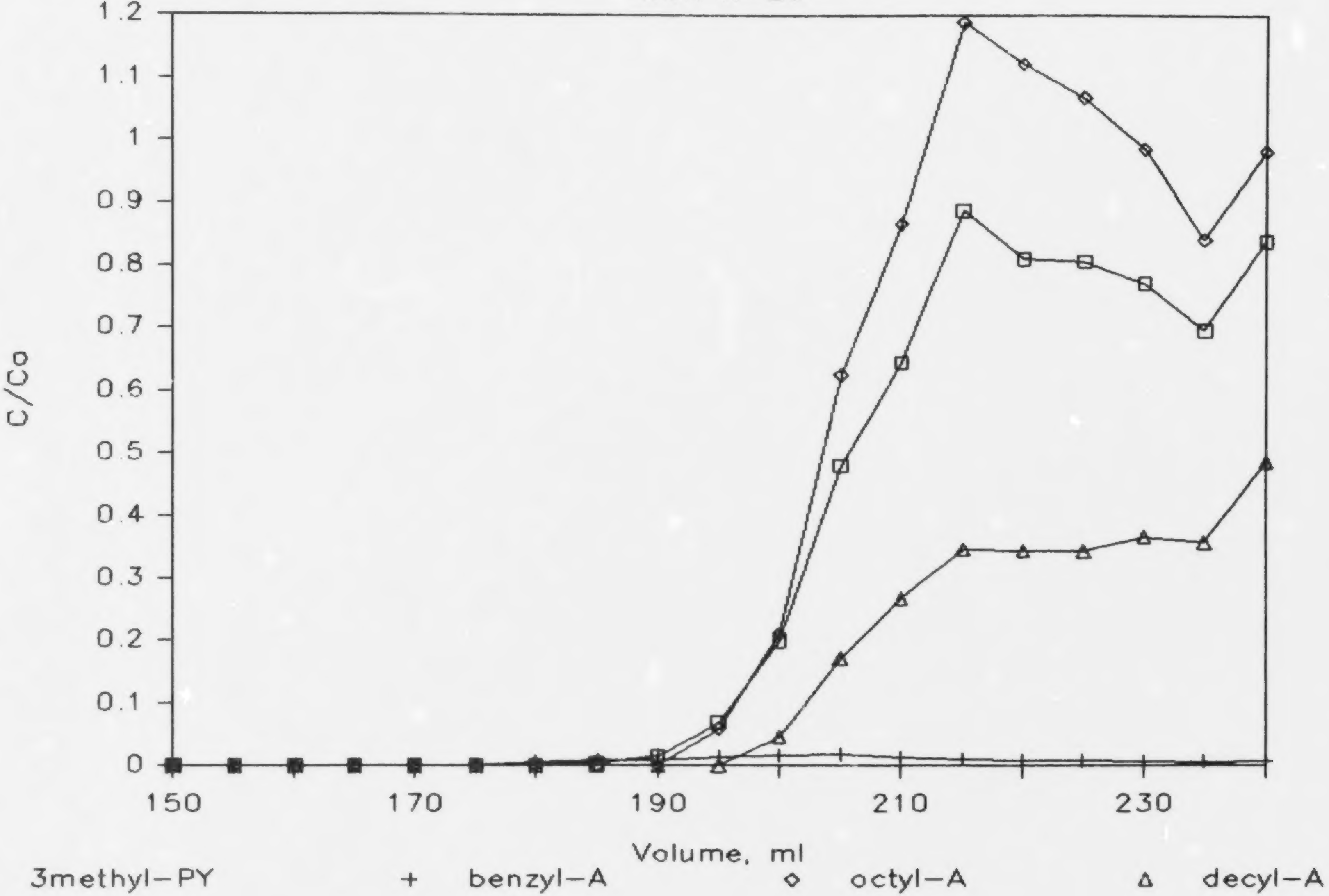
N-COMPOUNDS BREAKTHROUGH CURVES

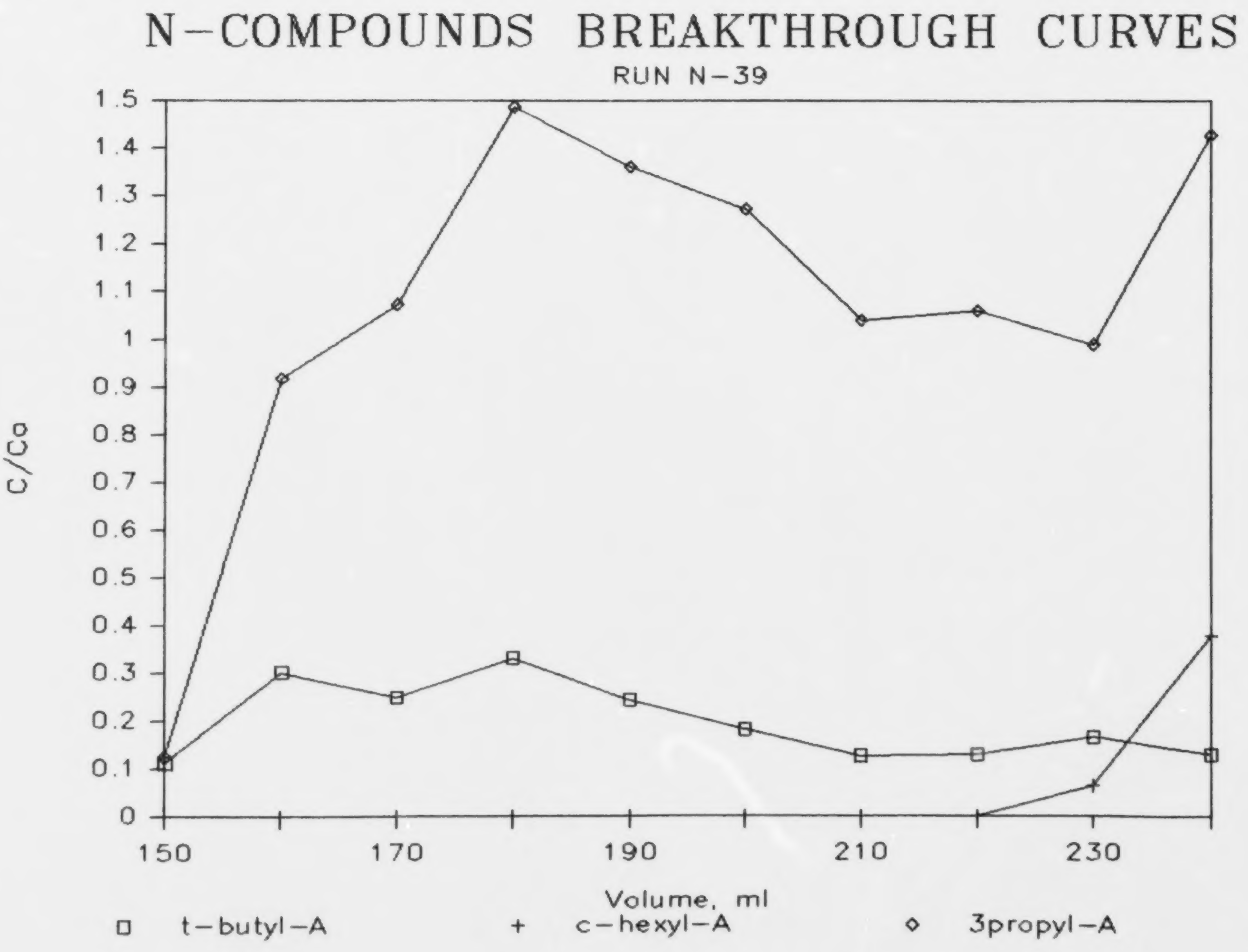
RUN N-23



N-COMPOUNDS BREAKTHROUGH CURVES

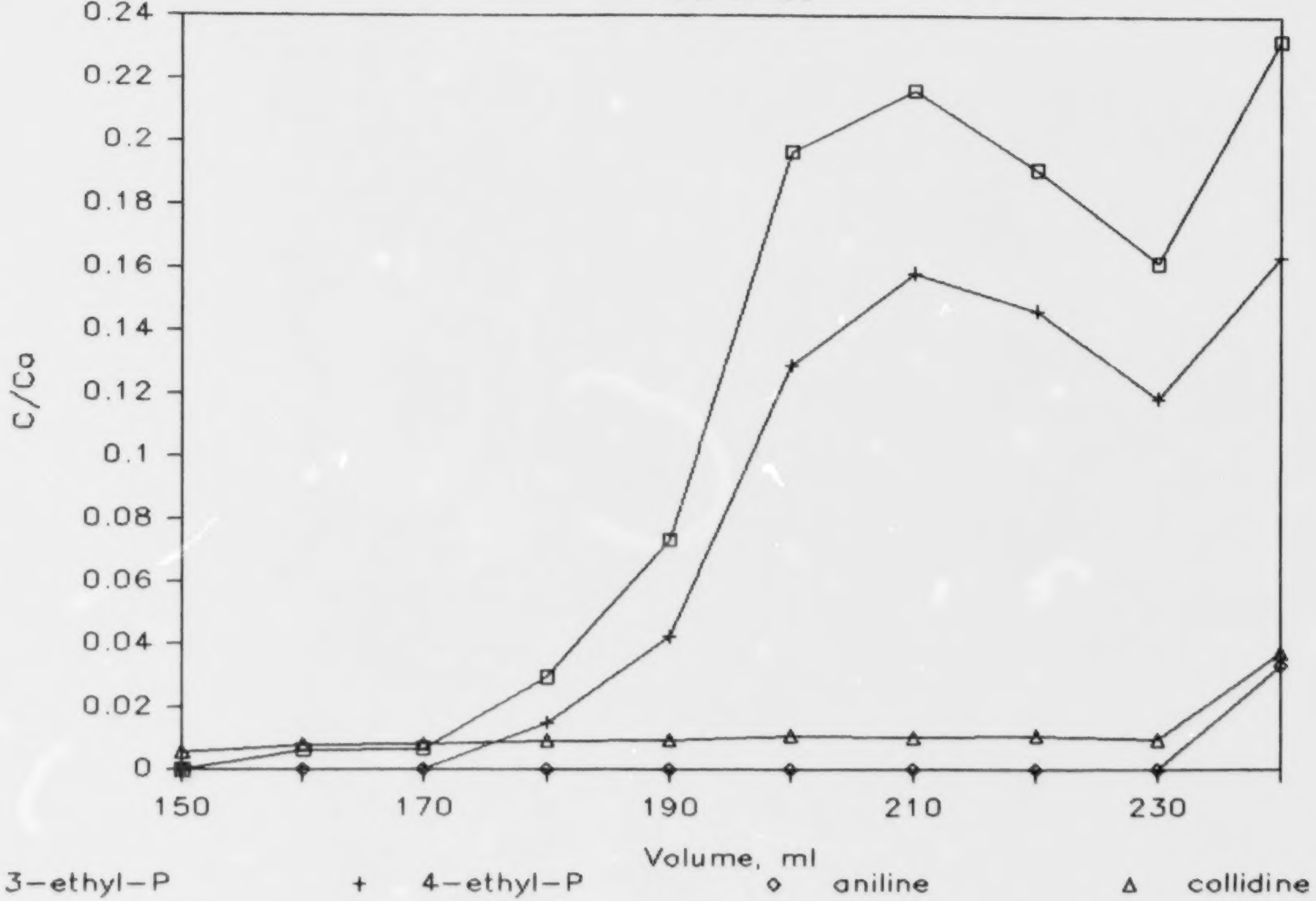
RUN N-23




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-39
C/Co
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
150
170
190
210
230
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

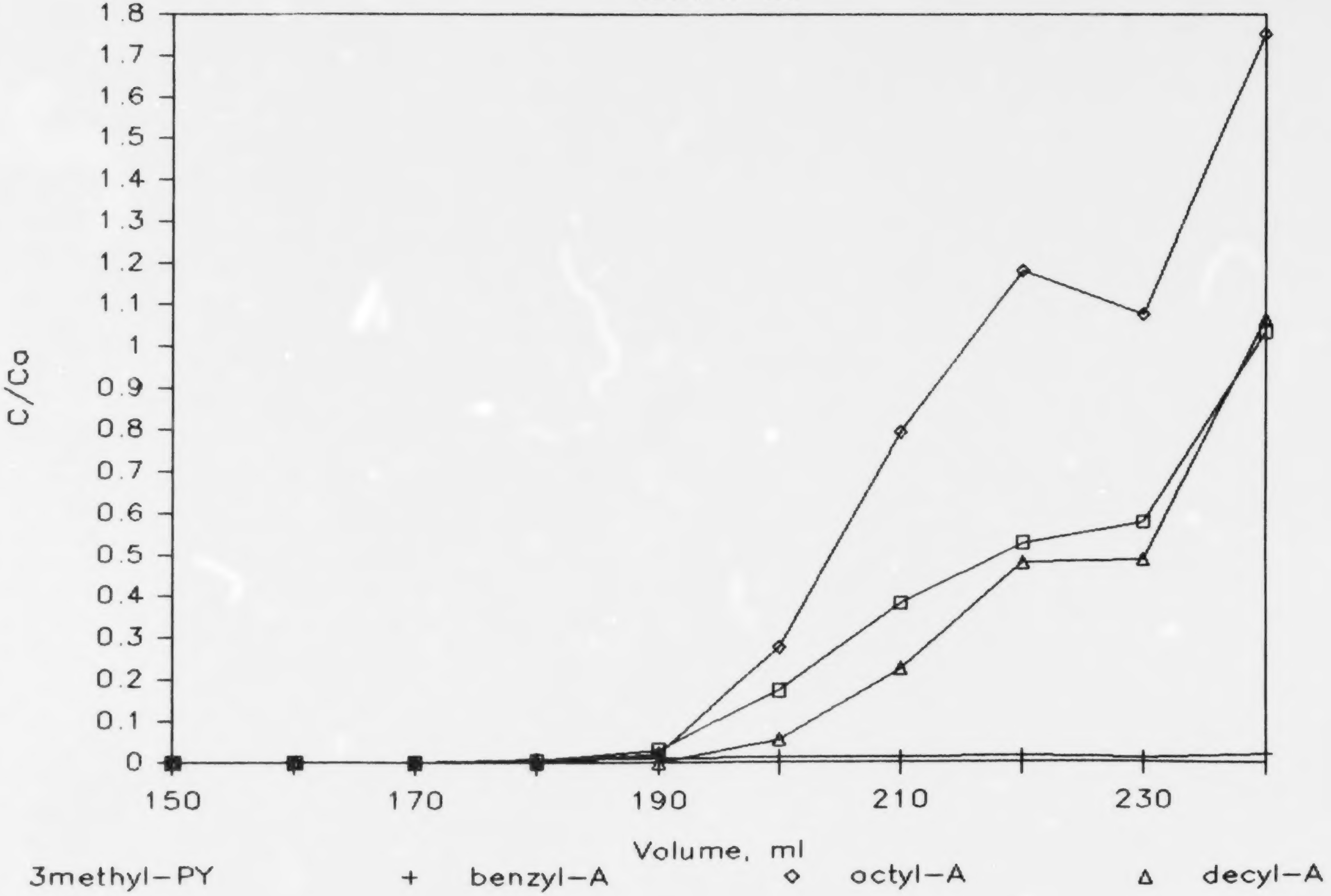
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N-·39



N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-39



Run N-48: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

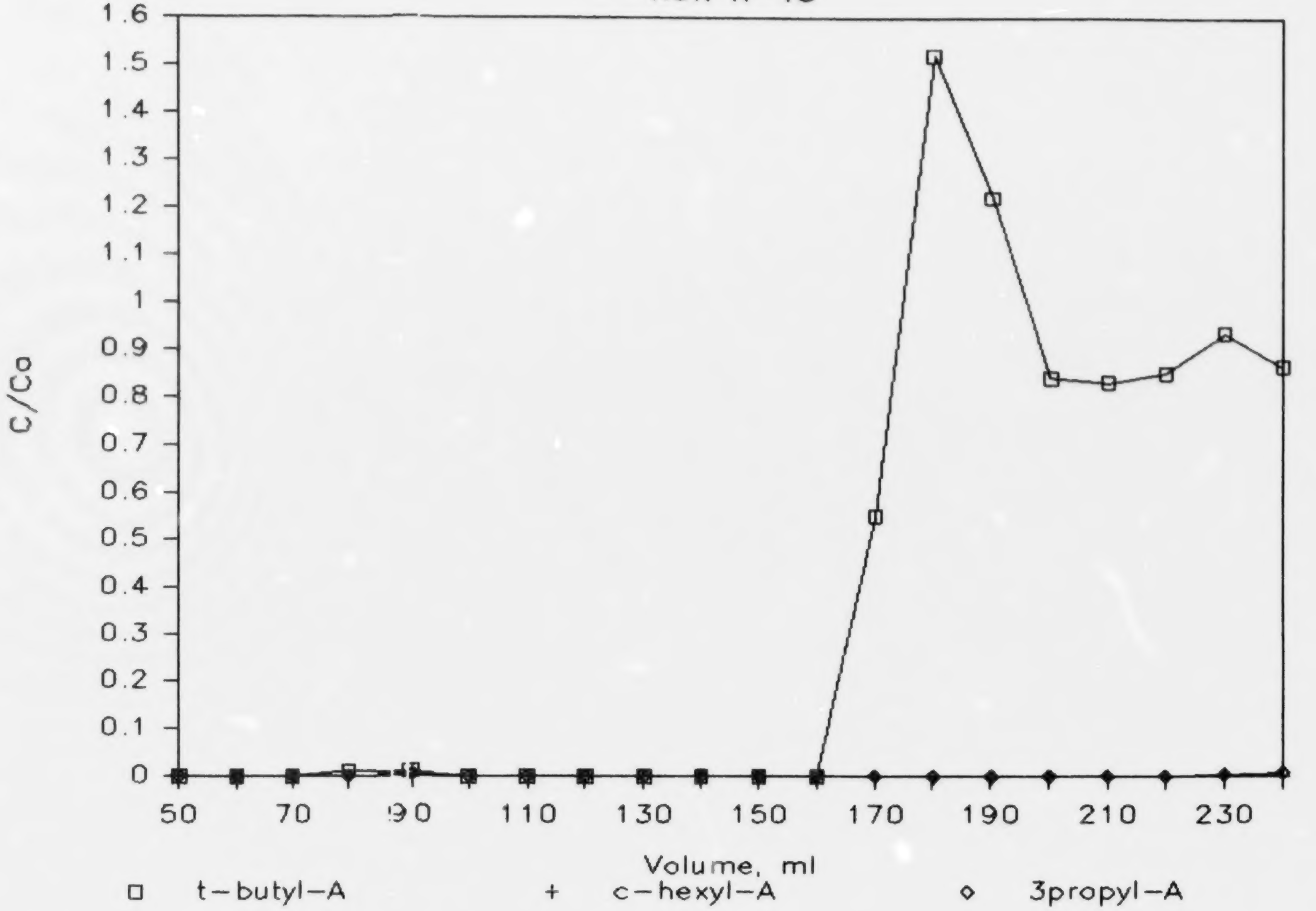
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0	0	0	0	0	0	0	0	0	0	0
6	60	0	0	0	0	0.02231276	0.01067493	0.01106471	0	0	0	0.02747383
7	70	0	0	0	0	0.04503648	0.00707182	0	0	0	0	0
8	80	0.01146572	0	0	0	0.07621374	0.00850628	0	0	0	0	0
9	90	0.00989662	0	0.00382479	0	0.06122161	0.00679502	0.00461713	0	0	0	0.01915854
10	100	0	0	0	0	0.03596191	0	0.00456538	0	0	0	0.02323352
11	110	0	0	0	0	0.02857933	0	0.00556354	0	0	0	0.02148856
12	120	0	0	0	0	0.02365517	0	0.00592960	0	0	0	0.01093698
13	130	0	0	0	0	0.02012389	0	0.00509800	0	0	0	0.02640107
14	140	0	0	0	0	0.01981498	0	0.00580702	0	0	0	0.03166676
15	150	0	0	0	0	0.01496240	0	0.00543932	0	0	0	0.02865150
16	160	0	0	0	0	0	0	0	0	0	0	0.02422875
17	170	0.54937923	0	0	0	0	0	0.00919189	0	0	0	0.00808564
18	180	1.52221061	0	0	0.00652556	0.01097222	0	0.01882747	0	0	0	0.00808338
19	190	1.21947713	0	0	0.00604051	0.00600612	0.02169951	0.23659119	0.00859202	0	0	0.01382147
20	200	0.83995228	0	0	0.00857425	0.01117806	0.05822460	0	0	0	0	0.03460232
21	210	0.83096112	0	0	0.01112615	0.01336271	0.17312470	0	0	0	0	0.04228917
22	220	0.85050076	0	0	0.02270055	0.01316626	0.36481680	0	0	0	0	0.04604638
23	230	0.93523527	0	0.00363673	0.25727046	0.02654342	0.54509492	0	0	0	0	0.05835956
24	240	0.86480582	0	0.00790276	1.09196654	0.06506428	0.63941152	0	0	0	0	0.06422515

Run N-48: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	10		530412
2	20		
3	30		
4	40		
5	50		
6	60	817162	
7	70	713114	
8	80	736266	
9	90	733448	
10	100	630608	
11	110	712451	
12	120	588646	
13	130	582894	
14	140	548258	
15	150	566591	
16	160	613863	
17	170	610581	
18	180	716019	
19	190	536407	
20	200	486301	
21	210	509360	
22	220	502594	
23	230	533011	
24	240	550167	

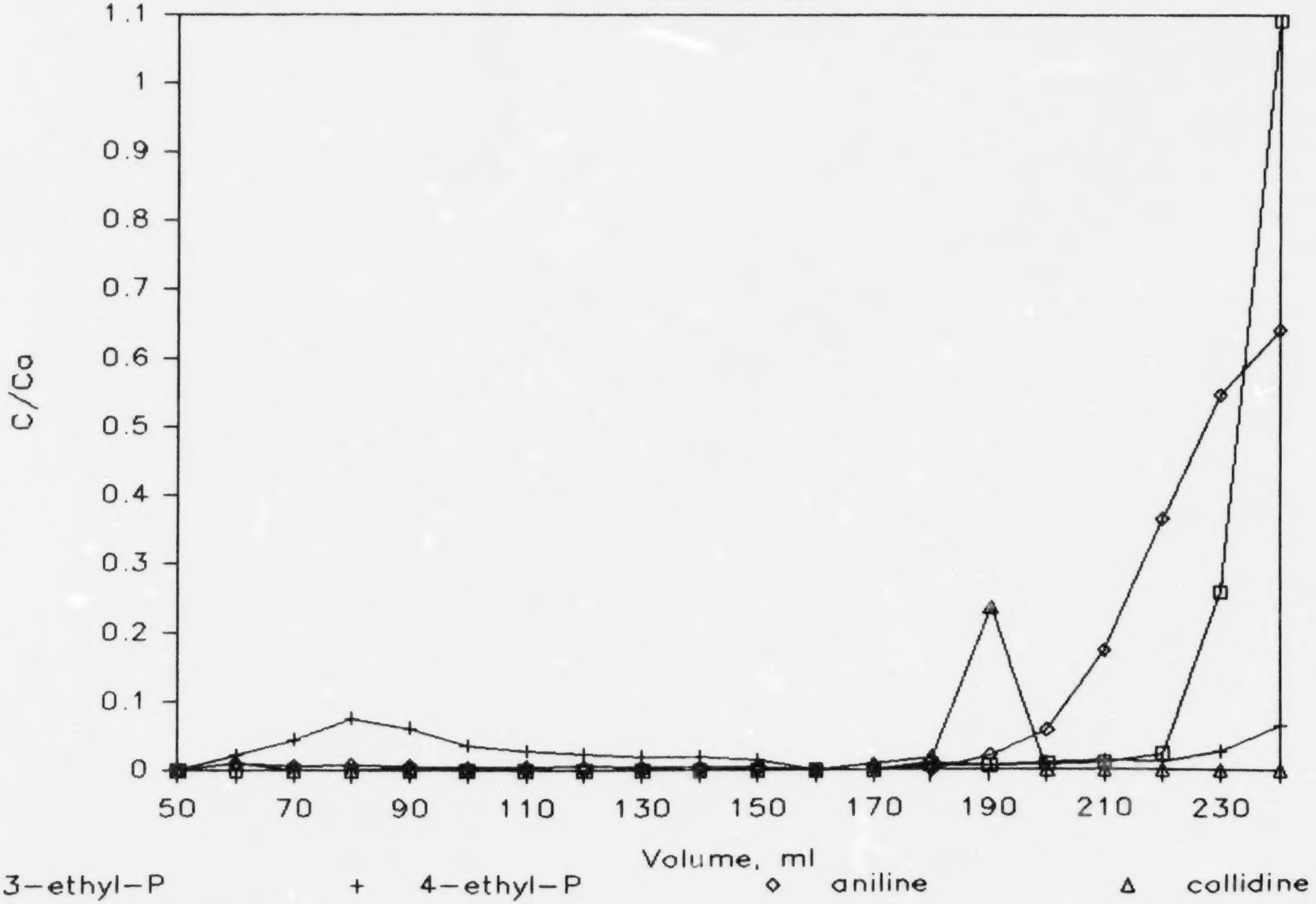
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-48



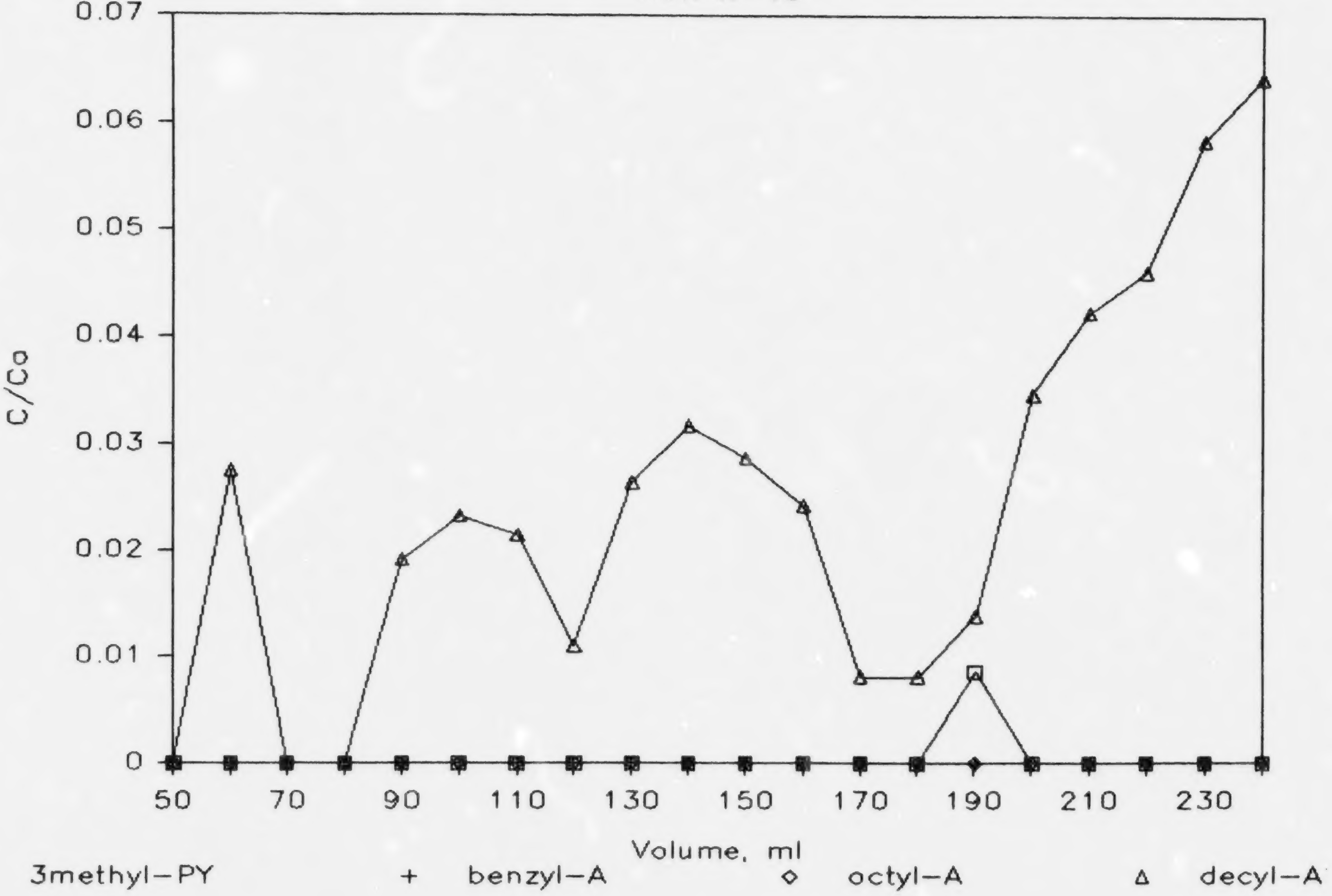
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-48



N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-48



Run N-58: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.02138357	0	0.00294790	0	0.10022012	0.01366155	0.00684514	0	0	0.00802805	0.00729232
6	60	0.03578796	0	0.00477366	0	0.09822194	0.01129270	0.00393774	0	0	0.00955796	0.00437021
7	70	0	0	0.00519183	0	0.07891675	0.01508103	0.01070459	0	0	0.01817000	0.01590015
8	80	0.00522426	0	0.00288138	0	0.07061957	0.00956038	0.00898701	0.00444072	0	0.01509554	0.01963796
9	90	0.01969597	0	0	0	0.06506808	0.01705835	0.01443944	0.10334846	0	0.02010554	0.02209532
10	100	0.01256366	0	0	0	0.05981135	0.01086835	0.01706087	0.00995411	0	0.01855008	0.02908233
11	110	0.01280376	0	0	0	0.04676864	0.00859308	0.01586016	0.00998512	0	0.01577176	0.03130983
12	120	0.02370969	0	0	0	0.04080952	0.00889605	0.01534749	0.01519291	0	0.01855545	0.03258078
13	130	0.15733729	0	0	0.00788214	0.02292107	0	0.01936634	0.01467471	0	0.01219412	0.02359601
14	140	0.71876173	0	0.00889991	0.01011069	0.01505160	0.01200705	0.01817929	0.01445502	0	0.01022218	0.00639522
15	150	1.57890275	0	0.00432692	0.00849448	0.01235744	0.03323459	0.05615113	0.02202191	0	0	0.01497477
16	160	1.69591571	0	0.00537432	0.01206726	0.01260081	0.11075485	0	0	0	0	0.04419217
17	170	1.44816952	0	0.00676031	0.01415882	0.00916599	0.19062104	0	0	0	0	0.06017738
18	180	1.55402931	0	0.00976453	0.06331001	0	0.41048270	0	0	0	0	0.09237722
19	190	1.51951624	0	0.01339806	0.38055086	0.03347987	0.75085213	0	0	0	0	0.11702291
20	200	0.59803689	0	0.00609777	0.72376676	0	0.59129668	0	0	0	0.02314244	0.07566100
21	210	0.90098521	0	0.00446246	1.03609498	0.11819485	0.61434779	0	0	0	0.00943628	0.08707402
22	220	1.10006294	0.05815699	0.01102412	1.38312103	0.24926131	0.66904228	0	0	0	0.02741877	0.10369027
23	230	0.98339403	0.14853569	0.01539556	1.46718514	0.39598452	0.72219490	0	0	0	0.02137198	0.11008762
24	240	0.76424482	0.67875912	0.02013527	1.48103791	0.60496140	0.71802213	0	0	0	0.02731560	0.09046995

Run N-58: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	10		913736
2	20		
3	30		
4	40		
5	50	1141360	
6	60	884043	
7	70	852464	
8	80	884983	
9	90	899621	
10	100	965750	
11	110	928439	
12	120	877350	
13	130	940112	
14	140	893645	
15	150	921600	
16	160	1073850	
17	170	1083900	
18	180	994561	
19	190	1118120	
20	200	806333	
21	210	818285	
22	220	845346	
23	230	785849	
24	240	787532	

Run R-58: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.19634461	0.14295373	0.04518946	0.80539369	0.74611480	0.88736433	0.66221168	0.23002127	0.80854385	0.22370881	0.40113389
2	100	0.04772478	0.03448764	0.01409739	0.22097350	0.28558351	0.25665111	0.14555427	0.07454652	0.31747438	0.05899167	0.09943447
3	150	0.01250617	0	0.00897093	0.17103671	0.21950221	0.16976415	0.11693603	0.03127856	0.16940506	0.02685924	0.06934201
4	200	0.01027930	0	0.00551423	0.16185911	0.19519901	0.14326496	0.10348638	0	0.13107833	0.01702181	0.03525890
5	250	0	0	0	0.10175193	0.14375227	0.09866380	0.07045770	0	0.08992386	0	0.02267305
6	300	0	0	0	0.06551486	0.09261135	0.05234372	0.03996546	0	0.04298232	0	0.01309934
7	350	0	0	0	0.06062695	0.09256859	0.05316957	0.03807680	0	0.03768586	0	0.00650462
8	400	0	0	0	0.04586879	0.06975694	0.03271353	0.02605777	0	0.02151444	0	0
9	450	0	0	0	0.04178629	0.06839374	0.03202866	0.02421840	0	0.01638646	0	0
10	500	0	0	0	0.03417562	0.05570493	0.02328429	0.01840117	0	0.01231144	0	0
11	550	0	0	0	0.02735538	0.45646544	0.01849819	0.01560401	0	0	0	0
12	600	2.58545328	0.01301665	0.03376774	0.02301261	0.30906151	0.05795191	0.01764702	0.25068921	0.04449625	0.19390442	0
13	650	0.14915024	0	0	0.03237414	0.07805298	0.05312068	0.01569792	0.12092974	0.06373961	0.12200700	0.04925349
14	700	0.03141577	0	0	0.02722339	0.04740751	0.02643907	0.01252672	0.01915049	0.00895619	0.00940157	0.03232614
15	750	0.00675460	0	0.00270771	0.02466997	0.04417413	0.02620786	0.01254594	0.01003695	0	0	0.00671153
16	800	0.00578886	0	0	0.01586496	0.03046585	0.01466712	0.00872841	0.00407861	0	0	0.01345852
17	850	0	0	0	0.01246542	0.02437452	0.01487922	0.00880179	0	0	0	0
18	900	0	0	0	0.01608907	0.03283958	0.01792129	0.01123577	0	0	0	0

Run R-58: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

#	ml	Toluene-S	Toluene-F
1	50	651816	913736
2	100	812034	
3	150	959394	
4	200	1186380	
5	250	834832	
6	300	720871	
7	350	817427	
8	400	780193	
9	450	825317	
10	500	809485	
11	550	778485	
12	600	810369	
13	650	793174	
14	700	853169	
15	750	894482	
16	800	756399	
17	850	769030	
18	900	971657	

Run N-66: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0.00443990	0.01238090	0.03784590	0.02399572	0.01866142	0.01946576	0	0	0
4	40	0	0	0	0	0.06168039	0.01070467	0.00406733	0.00467986	0	0.00305659	0
5	50	0.01806313	0	0.00405319	0	0.10270653	0.01336423	0.00564059	0.00392790	0	0	0
6	60	0.01769847	0	0.01060406	0	0.15385718	0.02061452	0.01238489	0.00909188	0	0	0
7	70	0	0	0.00423816	0	0.08471865	0.01167484	0.00638027	0.00819722	0	0	0.00406093
8	80	0	0	0.00430077	0	0.08289035	0.01257372	0.00238825	0.00889579	0	0	0.01304395
9	90	0	0	0	0	0.05071680	0.00945213	0	0.01147180	0	0	0.01665340
10	100	0	0	0	0	0.04358041	0.00668923	0.00280541	0.01058884	0	0	0.01812974
11	110	0.00893346	0	0	0	0.03680773	0.00495652	0	0.00851036	0	0	0.02464119
12	120	0.02096155	0	0	0	0.05043053	0.00560323	0	0.01409379	0	0	0.01628704
13	130	0	0	0	0	0.01914156	0	0.00295381	0.00684534	0	0	0.01650839
14	140	0.13259141	0	0	0.00443120	0.00840013	0	0.00688933	0.00865907	0	0	0.04479161
15	150	0.44030544	0	0	0.00377374	0.02014851	0	0.00516370	0.00459099	0	0	0.03810388
16	160	0.75788972	0	0.00524496	0.00761834	0.01378729	0.04113465	0.33095543	0.00863442	0	0	0.04135357
17	170	0.78527705	0	0.00560711	0.00961840	0.00595588	0.22072098	0	0	0	0	0.04834458
18	180	0.36129165	0	0.00559505	0.01753995	0	0.43838213	0	0	0	0	0.05443695
19	190	0.47543239	0	0.00510064	0.47389595	0	0.62977557	0	0	0	0	0.07245881
20	200	0.65600785	0	0.00690993	1.40877160	0.17056429	0.76654888	0	0	0	0	0.07575454
21	210	0.47092847	0.10999097	0.01302016	1.66229920	0.39192448	0.80593782	0	0	0	0	0.07918798
22	220	0.53948652	0.35980519	0.02256379	1.56993639	0.63527706	0.79131689	0	0	0	0	0.07371519
23	230	0.52128873	0.42626758	0.02891094	1.18508965	0.65188930	0.64797239	0	0	0	0	0.05962444
24	240											
25	DEP	0.26696747	0.23180827	0.18289187	0.60731238	0.50974032	0.49067749	0.59482489	0.28945401	0.13191028	0.13281344	0.19160420

Run N-66: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	10		785175
2	20		
3	30	968631	
4	40	797594	
5	50	1081000	
6	60	1134030	
7	70	1095720	
8	80	1079560	
9	90	825078	
10	100	885703	
11	110	902746	
12	120	1103190	
13	130	593769	
14	140	715899	
15	150	613468	
16	160	592720	
17	170	726376	
18	180	623842	
19	190	620241	
20	200	826429	
21	210	880923	
22	220	879625	
23	230	713729	
24	240		
25	DEP	741781	

Run R-66: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.34871492	0.52762109	0.22015111	0.93446027	0.99718843	1.07775557	0.82317917	0.42124709	0.98025138	0.36618447	0.29353171
2	100	0.05951276	0.15171471	0.05148058	0.43497558	0.55404925	0.50831800	0.33070357	0.15646933	0.20587874	0.03645818	0.07603222
3	150	0	0.05088387	0.01330237	0.21766684	0.26589260	0.18847554	0.14948526	0.03242833	0.20587834	0.03645809	0.07603273
4	200	0	0.01475145	0.00539527	0.15919056	0.22836230	0.13241335	0.11996588	0	0.11102206	0.02310805	0.02984513
5	250	0	0	0	0.12326635	0.18339958	0.08996801	0.08272304	0	0.05324917	0	0.02270817
6	300	0	0	0	0.09879369	0.15346620	0.06787643	0.06257338	0	0.02983152	0	0
7	350	0	0	0	0.07117548	0.11868457	0.05020518	0.04492382	0	0.01964844	0	0
8	400	0	0	0	0.05697551	0.09523955	0.03299113	0.03164871	0	0	0	0
9	450	0	0	0	0.04328580	0.07889327	0.02679862	0.02429224	0	0	0	0
10	500	0	0	0	0.02992612	0.06389062	0.02631453	0.01854694	0	0	0	0
11	550	0	0	0	0.02423712	0.05557569	0.02315143	0.01577067	0	0	0	0
12	600	0	0	0	0.01833353	0.04690145	0.01984635	0.01280041	0	0	0	0
13	650	0	0	0	0.01676963	0.04522313	0.01927092	0.01225594	0	0	0	0
14	700	0	0	0	0.01418163	0.04149595	0.01806772	0.01122264	0	0	0	0
15	750	0	0	0	0.01104955	0.03600167	0.01589697	0.00973200	0	0	0	0
16	800	0	0	0	0.00904017	0.03194697	0.01442249	0.00870036	0	0	0	0
17	850	0	0	0	0.00672744	0.02625439	0.01214697	0.00600596	0	0	0	0
18	900	0	0	0	0.00583571	0.02400454	0.01147903	0.00563069	0	0	0	0

Run R-66: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

#	ml	Toluene-S	Toluene-F
1	50	666828	785175
2	100	713262	
3	150	711346	
4	200	734183	
5	250	768000	
6	300	843220	
7	350	791071	
8	400	808307	
9	450	796096	
10	500	763319	
11	550	751061	
12	600	779416	
13	650	796413	
14	700	797298	
15	750	788497	
16	800	796468	
17	850	741468	
18	900	762913	

Run N-67: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0.00580075	0.00894458	0.02390372	0.02123938	0.01748754	0.00989243	0	0	0
5	50	0	0	0	0	0.02124762	0	0	0	0	0	0
6	60	0	0	0	0	0.04896303	0.00609673	0	0	0	0	0
7	70	0	0	0.00524224	0	0.06417848	0.00657073	0	0.00544386	0	0	0
8	80	0	0	0.00442892	0	0.05223463	0.00545461	0	0.00669566	0	0	0
9	90	0	0	0.00351875	0	0.03837082	0.00469211	0	0.00717648	0	0	0
10	100	0	0	0.00338373	0	0.04259922	0.00526372	0	0.00982198	0	0	0
11	110	0	0	0.00342929	0	0.04894270	0.00569932	0	0.01217149	0	0	0.01720801
12	120	0	0	0.00349586	0	0.05432325	0.00654592	0	0.01589995	0	0	0.01627917
13	130	0	0	0	0	0.04421700	0.00596094	0	0.01725544	0	0	0.02524685
14	140	0.02129308	0	0	0	0.01777349	0	0	0.00808715	0	0	0.02223354
15	150	0.10566683	0	0	0	0.01389256	0	0.00341418	0.01122339	0	0	0.01716739
16	160	0.97002097	0	0	0.00596280	0.01216422	0	0.00531907	0.01074913	0	0	0.01986537
17	170	0.93548526	0	0	0.01067603	0.01363725	0.04339512	0.23100738	0.01357371	0	0	0.02249313
18	180	0.51292274	0	0.00641163	0.02030097	0.01488033	0.12078009	0	0	0	0	0.05423971
19	190	0.54801083	0	0.01534809	0.02906086	0.01054392	0.12378478	0	0	0	0	0.05548124
20	200	0.57361108	0	0.02066824	0.11288609	0	0.31234591	0	0	0	0	0.08194316
21	210	0.37811971	0	0.02196428	0.65710119	0	0.49825411	0	0	0	0	0.11788418
22	220	0.56515544	0	0.02544197	1.37345165	0	0.66290022	0	0	0	0	0.10851338
23	230	0.37111252	0	0.02314831	1.97790366	0.44859313	0.77767848	0	0	0	0	0.17626192

Run N-67: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	10		596997
2	20		
3	30		
4	40	737758	
5	50	750001	
6	60	742803	
7	70	738462	
8	80	743129	
9	90	797829	
10	100	758858	
11	110	782000	
12	120	811440	
13	130	819592	
14	140	812522	
15	150	799944	
16	160	828240	
17	170	790274	
18	180	829770	
19	190	769334	
20	200	763025	
21	210	746732	
22	220	759819	
23	230	730957	

Run R-67: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

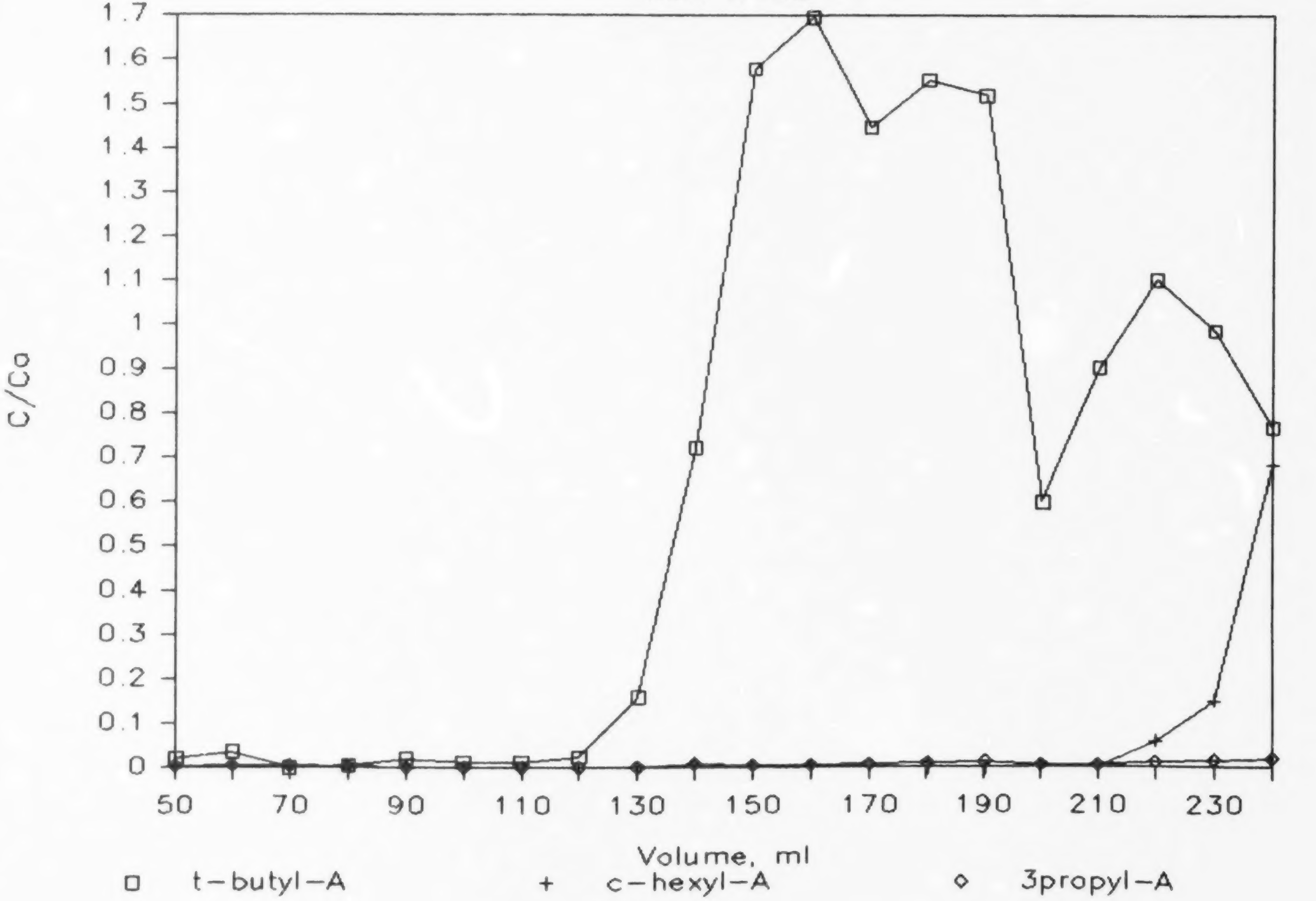
						C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0.37634713	0.69372795	0.24670323	1.31273516	1.12910793	1.41424560	1.11043784	0.57445633	1.19921759	0.49684489	0.59527335
2	100	0.03800599	0.11937168	0.05485837	0.44033340	0.49895895	0.55412680	0.36182607	0.19064892	0.52874246	0.10737810	0.11452854
3	150	0.01337672	0.02480878	0.01410448	0.26488332	0.28224218	0.26394214	0.20518847	0.04739452	0.25797822	0.01837029	0.05973329
4	200	0	0	0.00589065	0.20847786	0.26331667	0.19219049	0.17628954	0	0.18154935	0	0.03651004
5	250	0	0	0	0.15264104	0.20003126	0.12423694	0.12235602	0	0.10603375	0	0.02339413
6	300	0	0	0	0.08686364	0.12356160	0.06614367	0.06423138	0	0.03917263	0	0.01051131
7	350	0	0	0	0.08725903	0.12815633	0.06163491	0.05983899	0	0.03479279	0	0
8	400	0	0	0	0.07778717	0.11884270	0.05374439	0.05141592	0	0.02136454	0	0
9	450	0	0	0	0.06353452	0.10431201	0.04518310	0.04108065	0	0.01409041	0	0
10	500	0	0	0	0.05210917	0.09117801	0.03841253	0.03329584	0	0	0	0
11	550	0	0	0	0.03939558	0.07662926	0.03399081	0.02766268	0	0	0	0
12	600	0	0	0	0.04981393	0.09660985	0.04018046	0.03203515	0	0	0	0
13	650	0	0	0	0.03809253	0.08119250	0.03413787	0.02566597	0	0	0	0
14	700	0	0	0	0.03056660	0.07144477	0.03090609	0.02237378	0	0	0	0
15	750	0	0	0	0.02404049	0.06180449	0.02767943	0.01941831	0	0	0	0
16	800	0	0	0	0.02092214	0.05875564	0.02677863	0.01837761	0	0	0	0
17	850	0	0	0	0.01449421	0.04664736	0.02202713	0.01471610	0	0	0	0
18	900	0	0	0	0.01301266	0.04472069	0.02154268	0.01440638	0	0	0	0

Run R-67: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Toluene as regeneration solvent

#	ml	Toluene-S	Toluene-F
1	50	709303	596997
2	100	779546	
3	150	791385	
4	200	815184	
5	250	800357	
6	300	625209	
7	350	789509	
8	400	831892	
9	450	838176	
10	500	840807	
11	550	832680	
12	600	1244300	
13	650	1234790	
14	700	1220940	
15	750	1185830	
16	800	1279760	
17	850	1122600	
18	900	1192040	

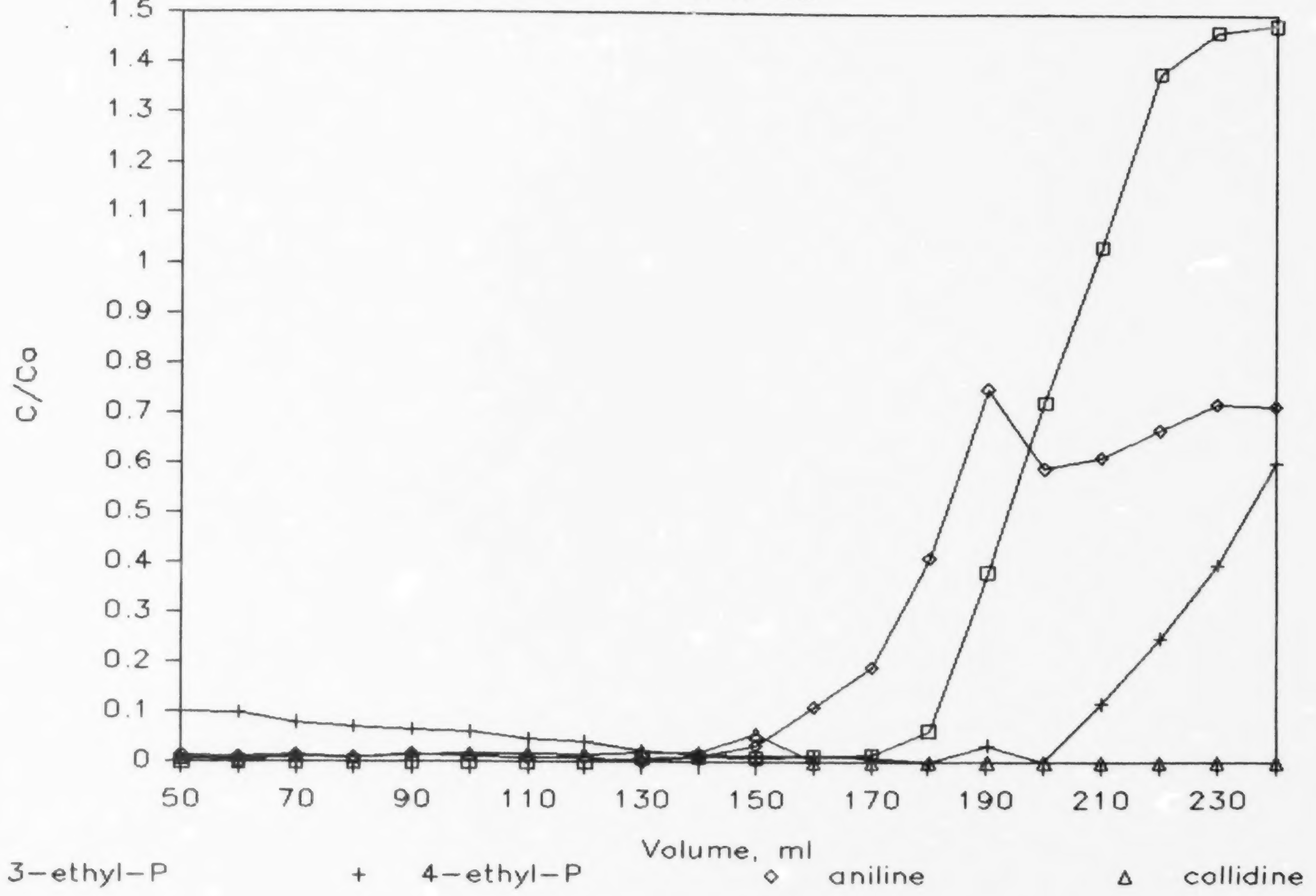
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-58



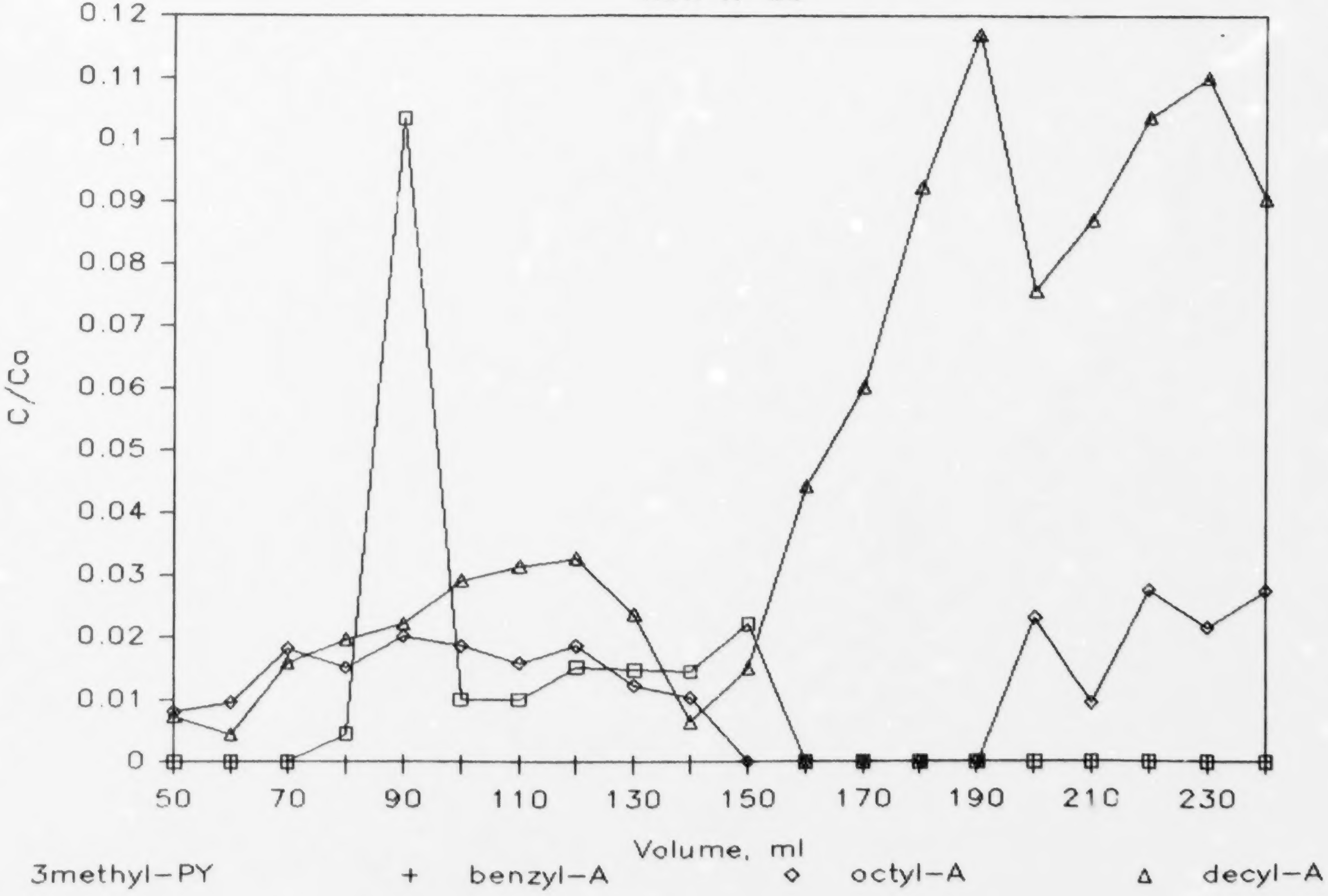
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-58



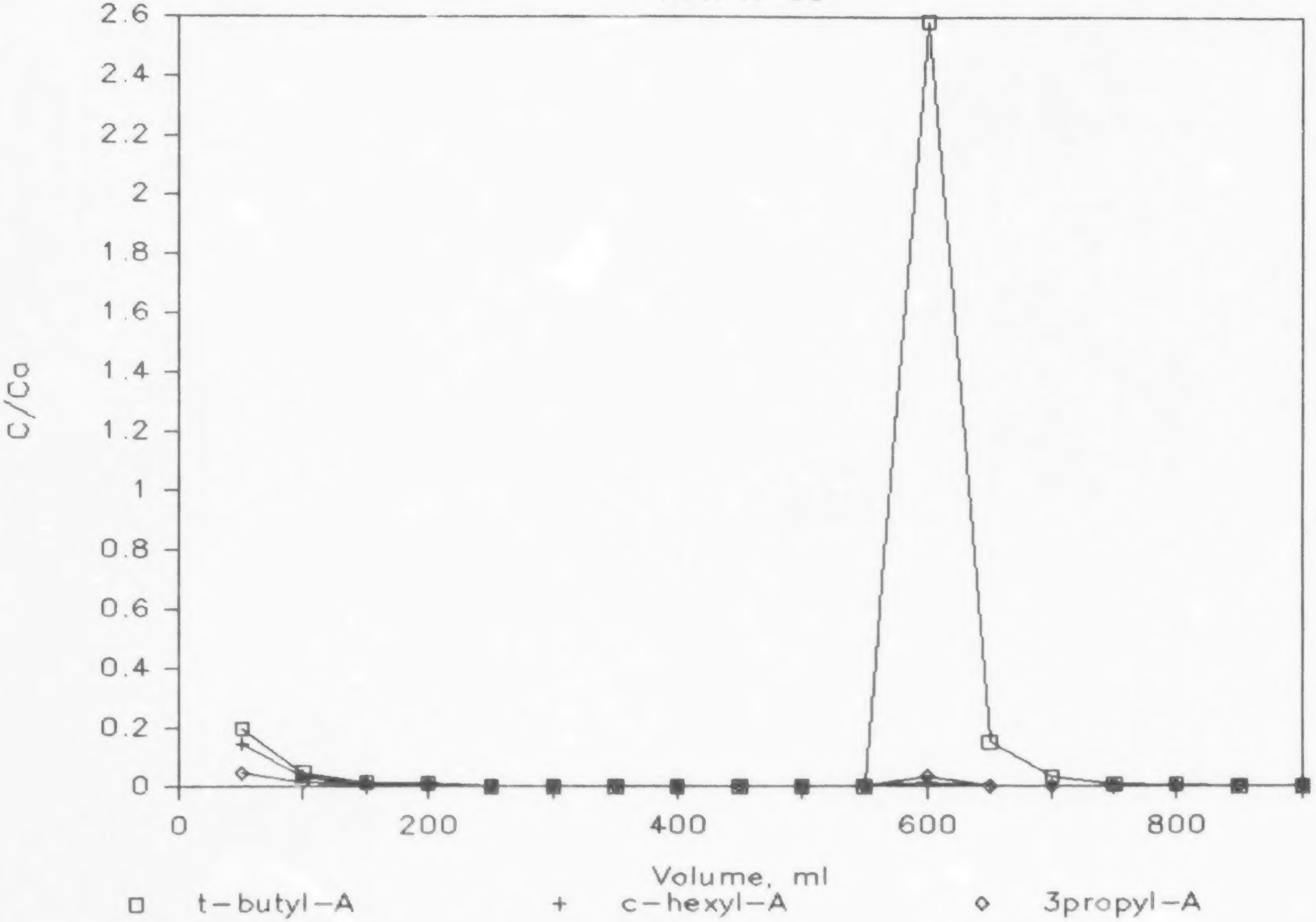
N-COMPOUNDS BREAKTHROUGH CURVES

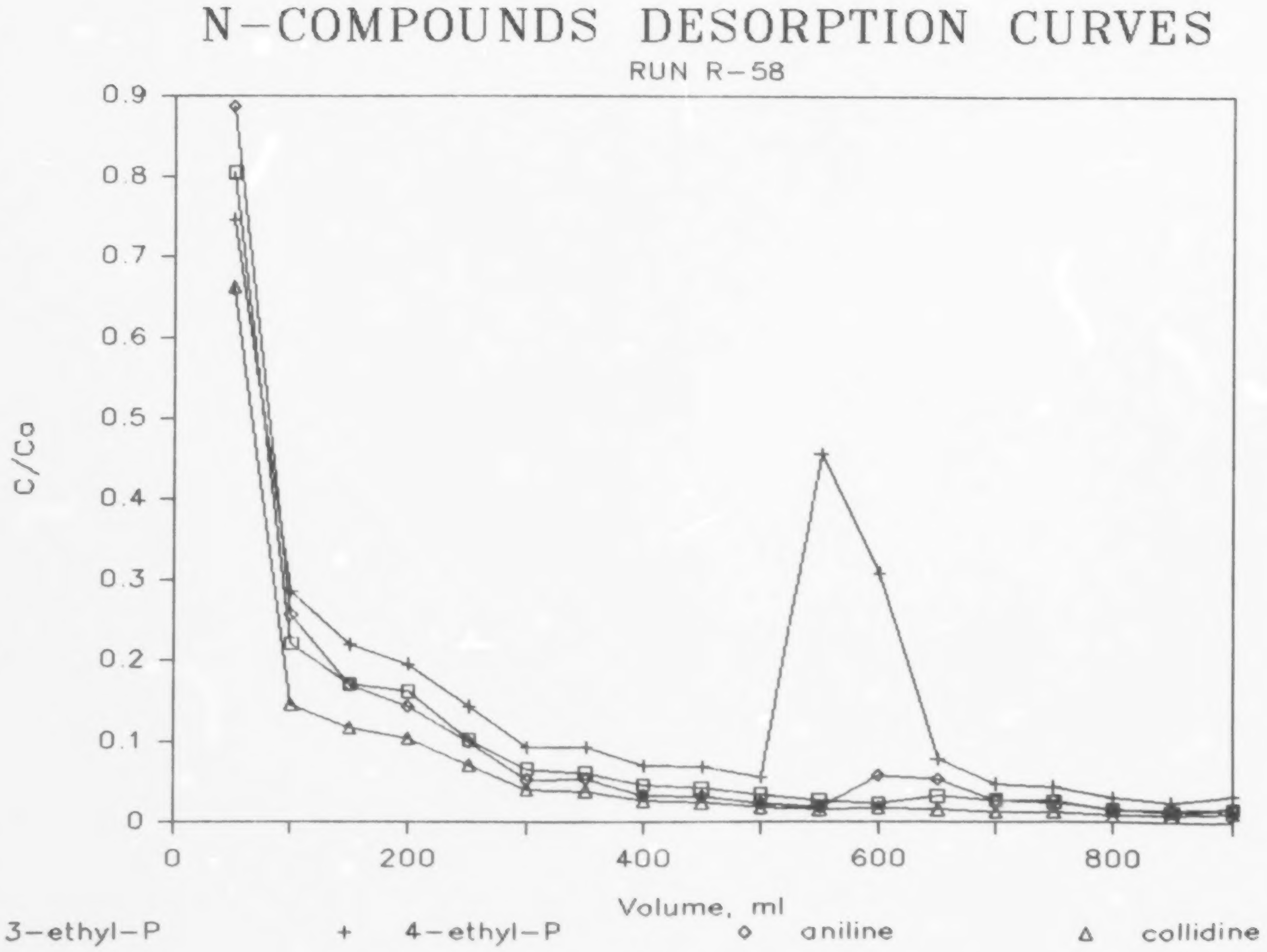
RUN N-58



N-COMPOUNDS DESORPTION CURVES

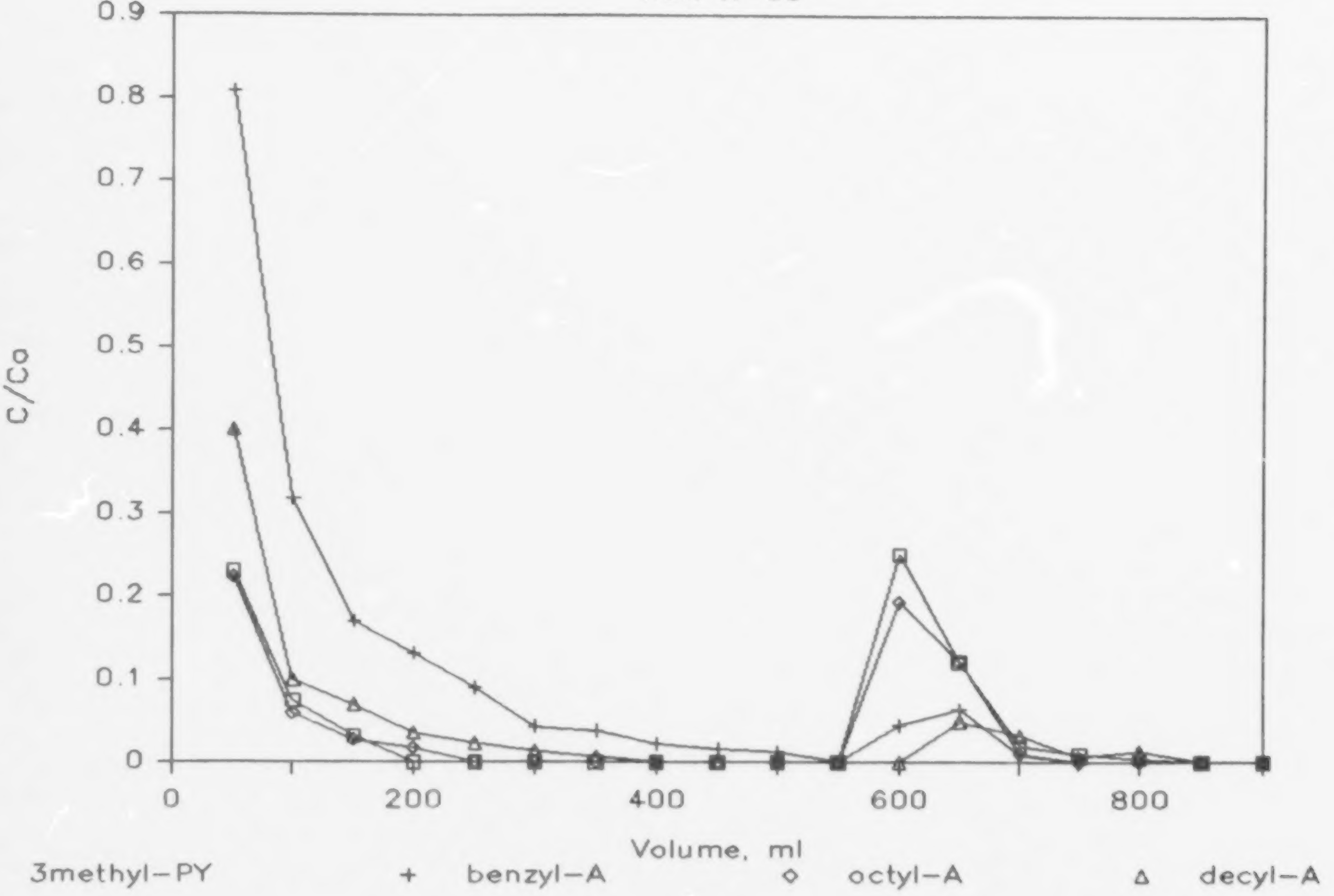
RUN R-58

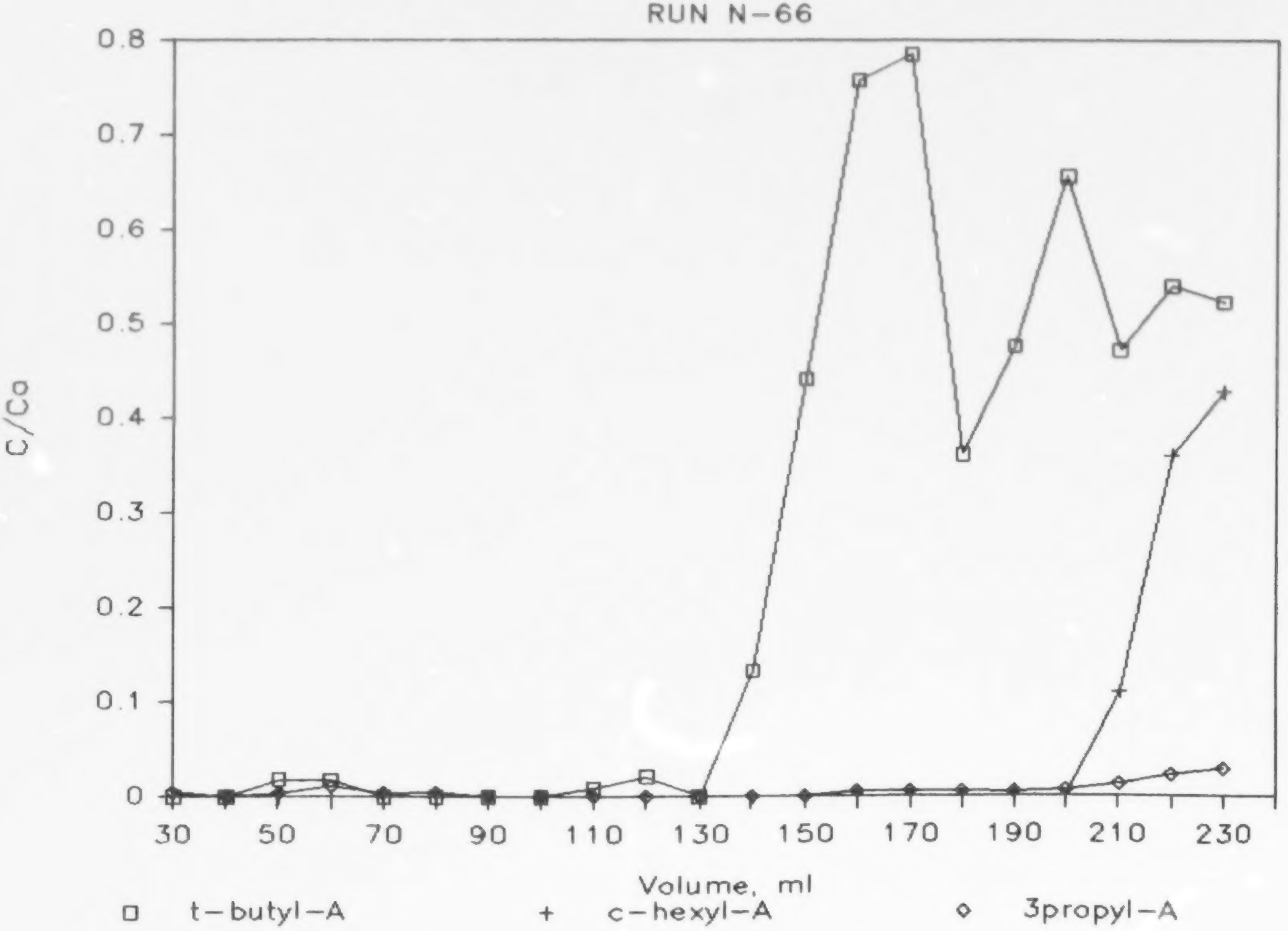



N-COMPOUNDS DESORPTION CURVES
RUN R-58
C/Co
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
200
400
600
800
Volume, ml
3-ethyl-P
+ 4-ethyl-P
◇ aniline
△ collidine

N-COMPOUNDS DESORPTION CURVES

RUN R-58

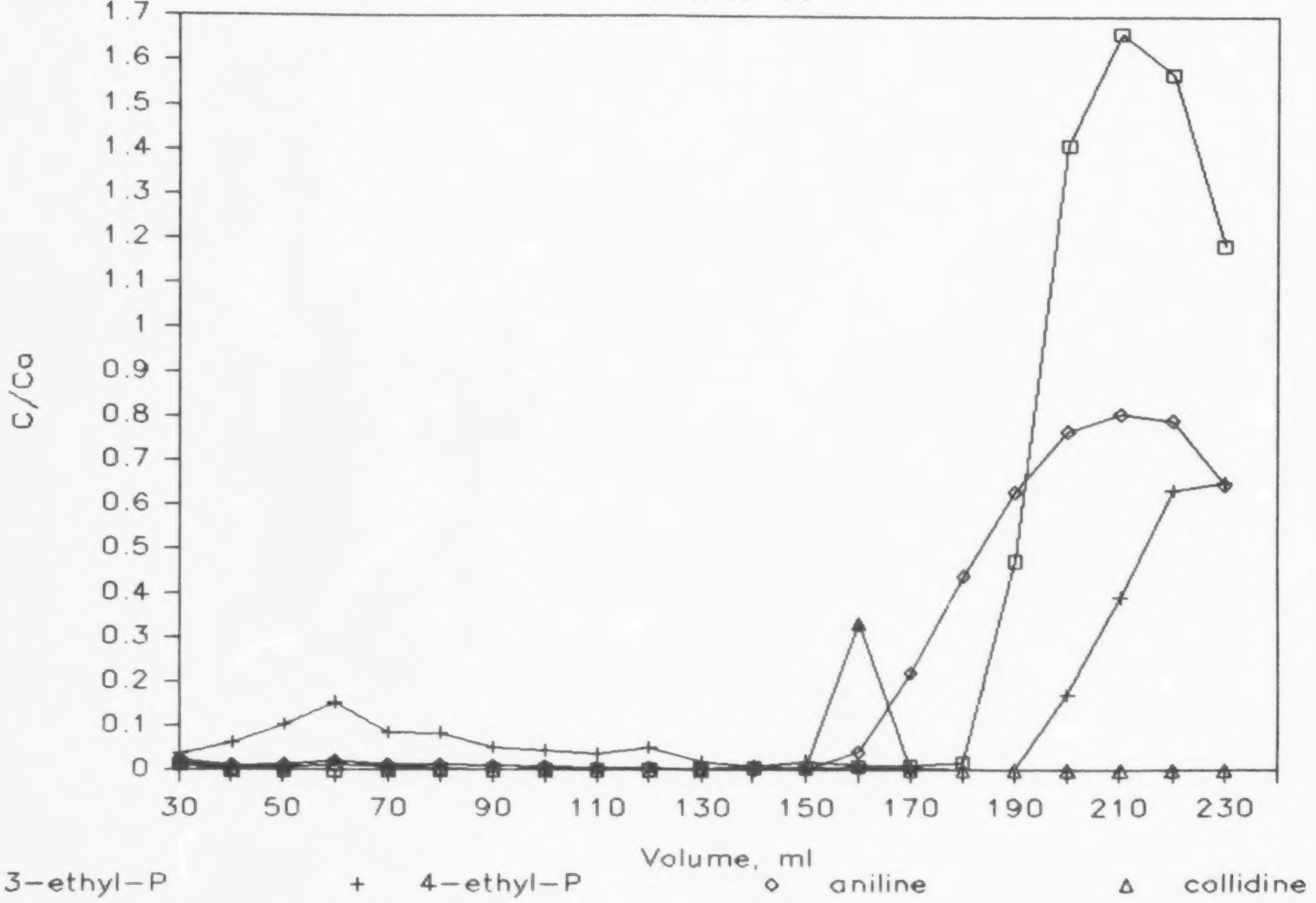


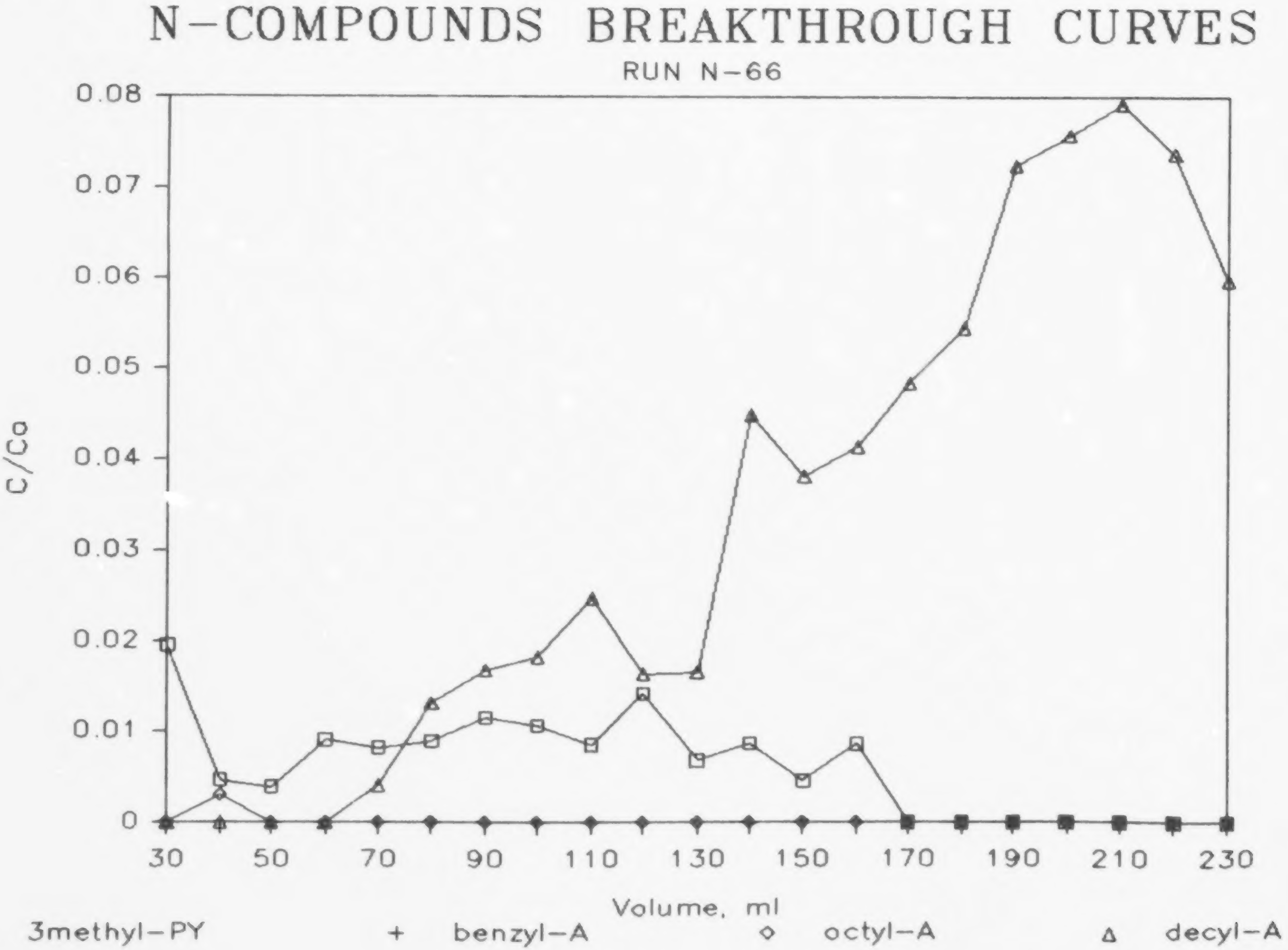


N-COMPOUNDS BREAKTHROUGH CURVES

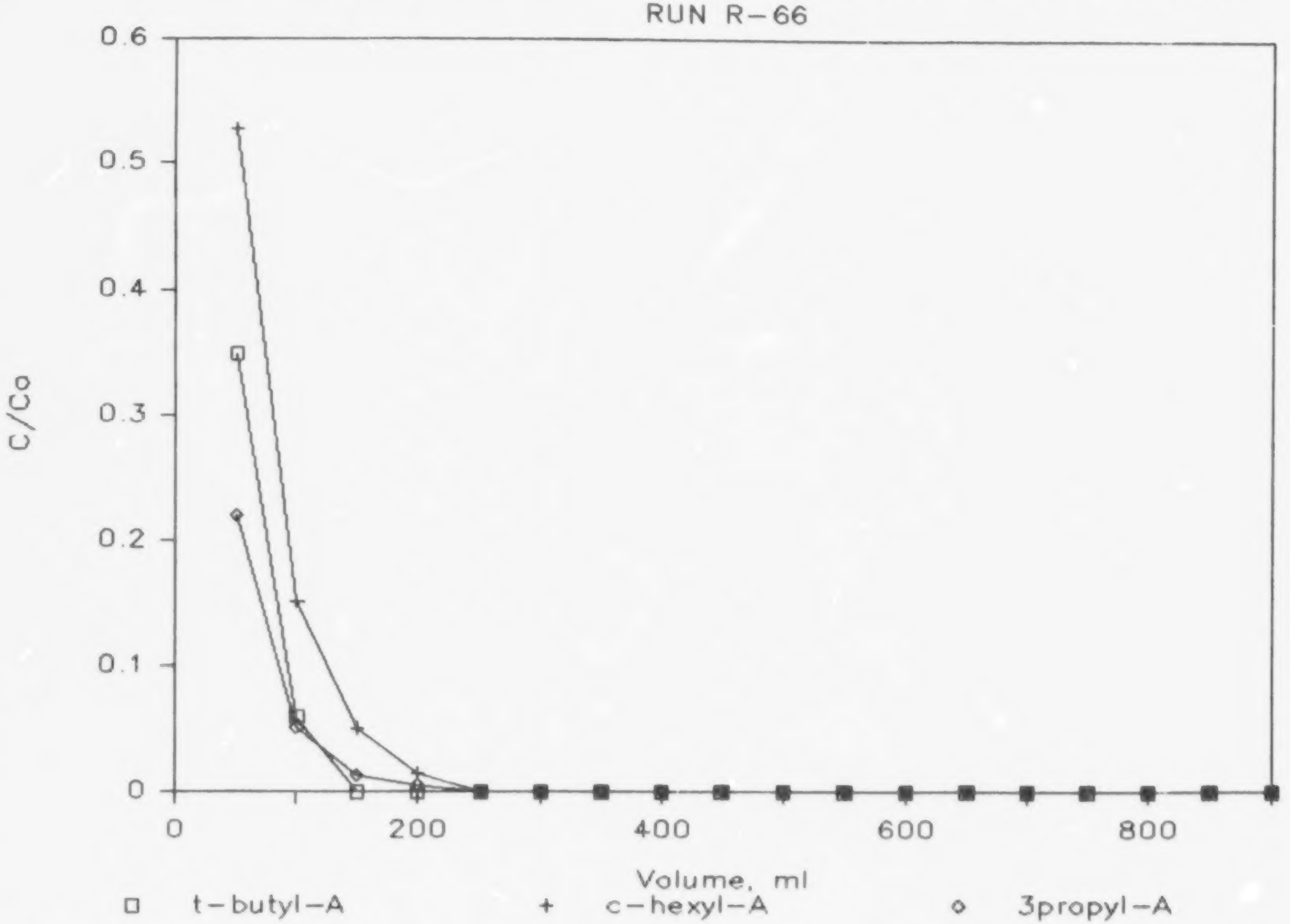
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–66



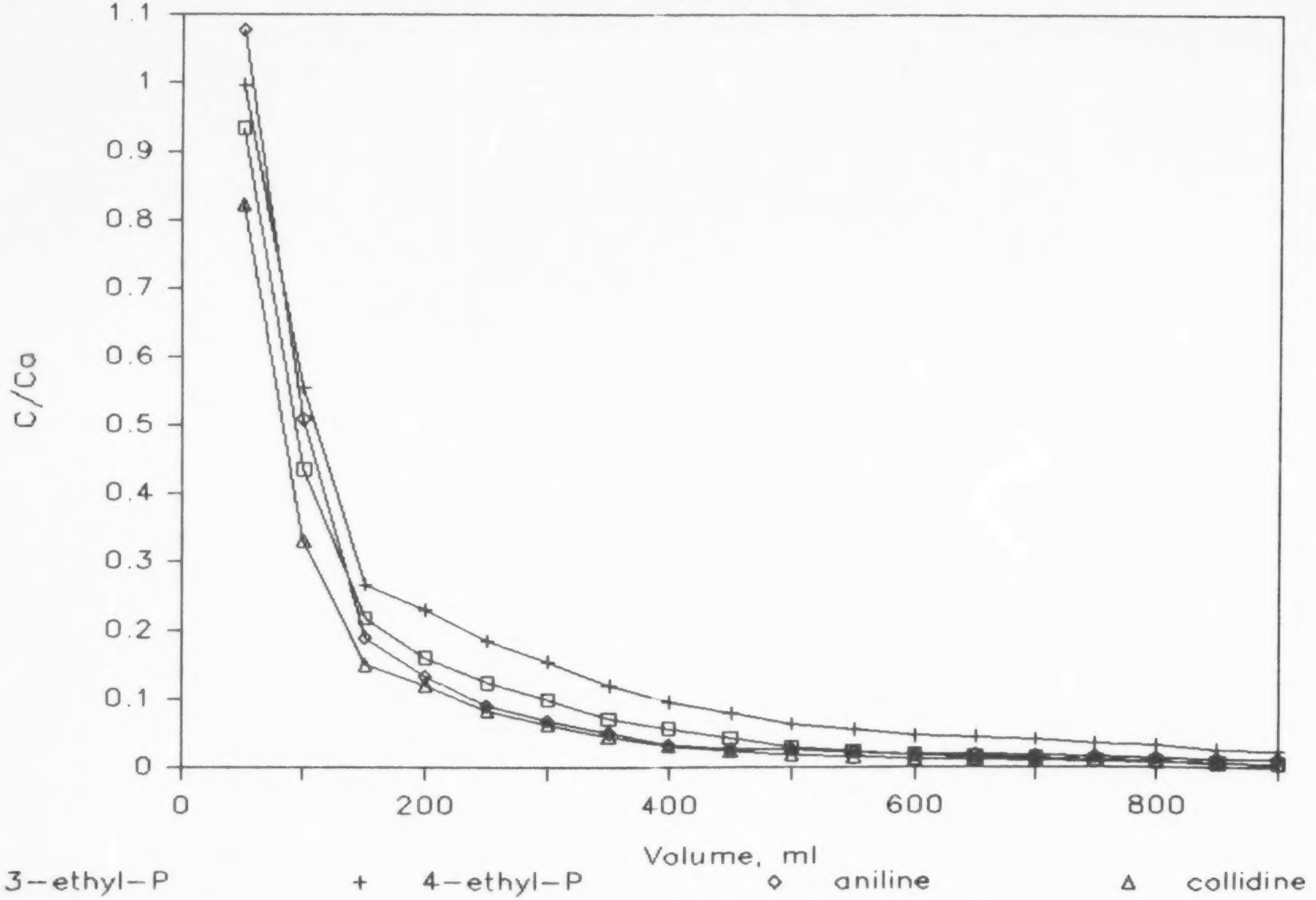

N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-66
C/Co
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
30
50
70
90
110
130
150
170
190
210
230
Volume, ml
3methyl-PY
+ benzyl-A
◇ octyl-A
Δ decyl-A

N-COMPOUNDS DESORPTION CURVES



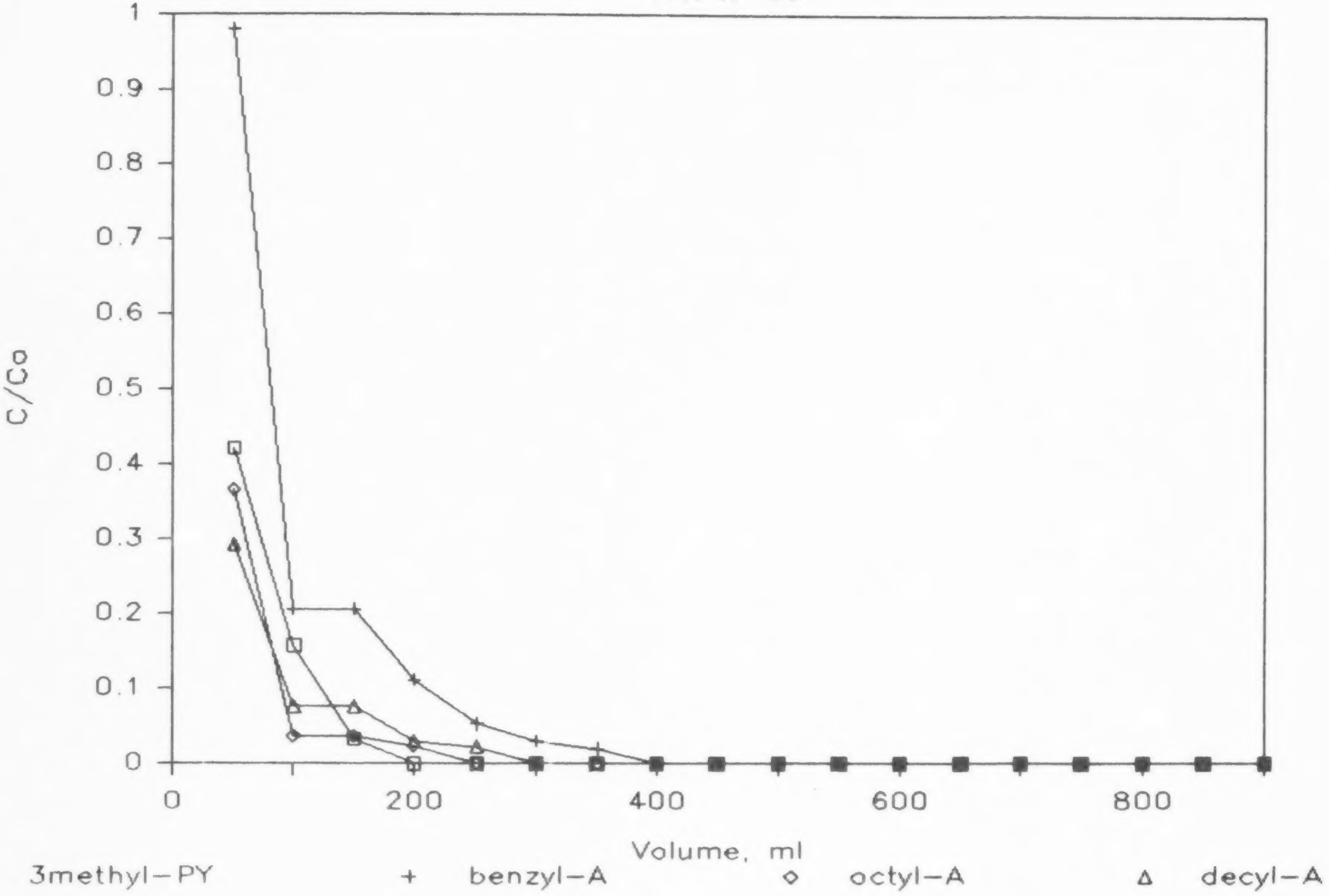
N-COMPOUNDS DESORPTION CURVES

RUN R-66



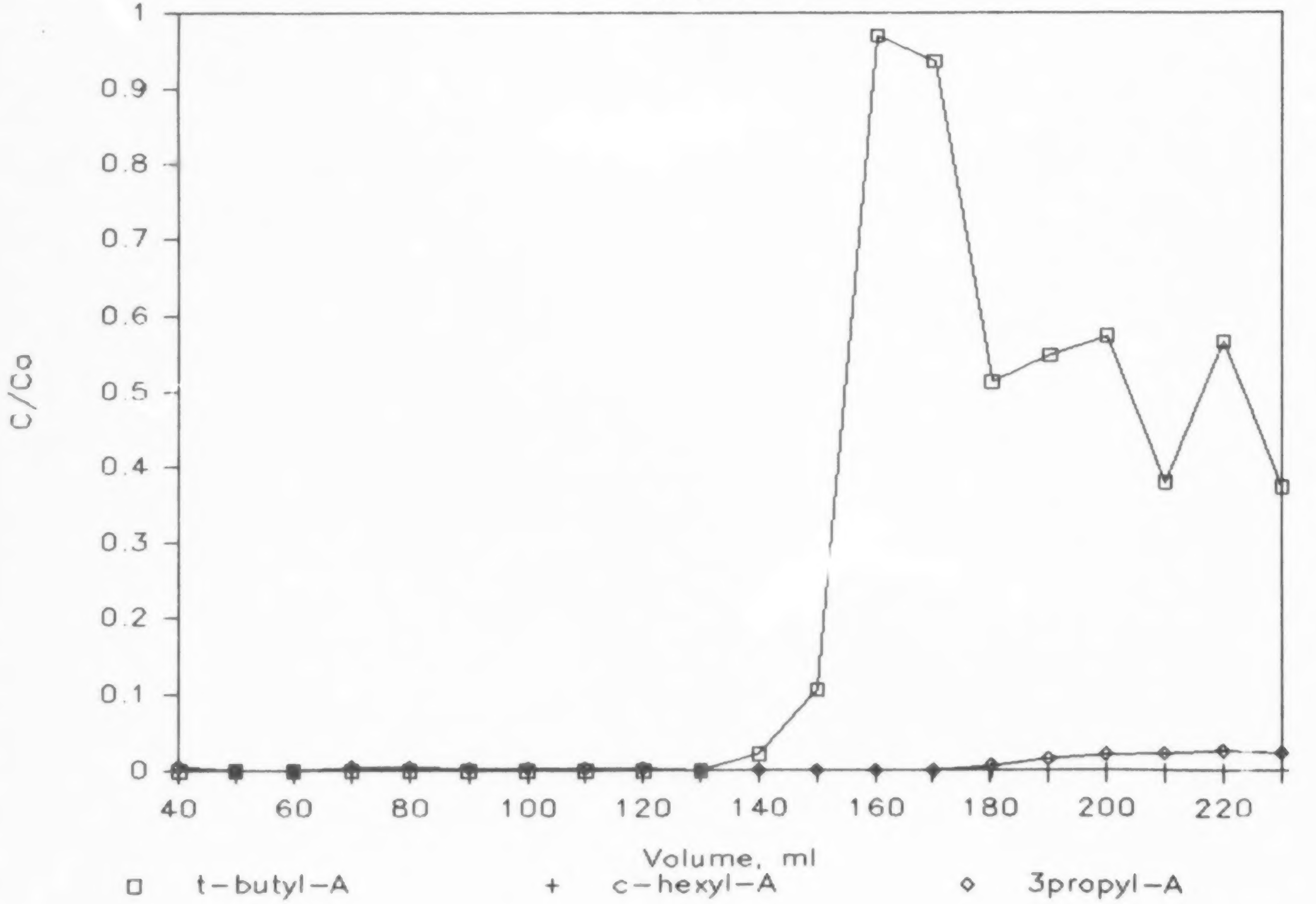
N-COMPOUNDS DESORPTION CURVES

RUN R-66



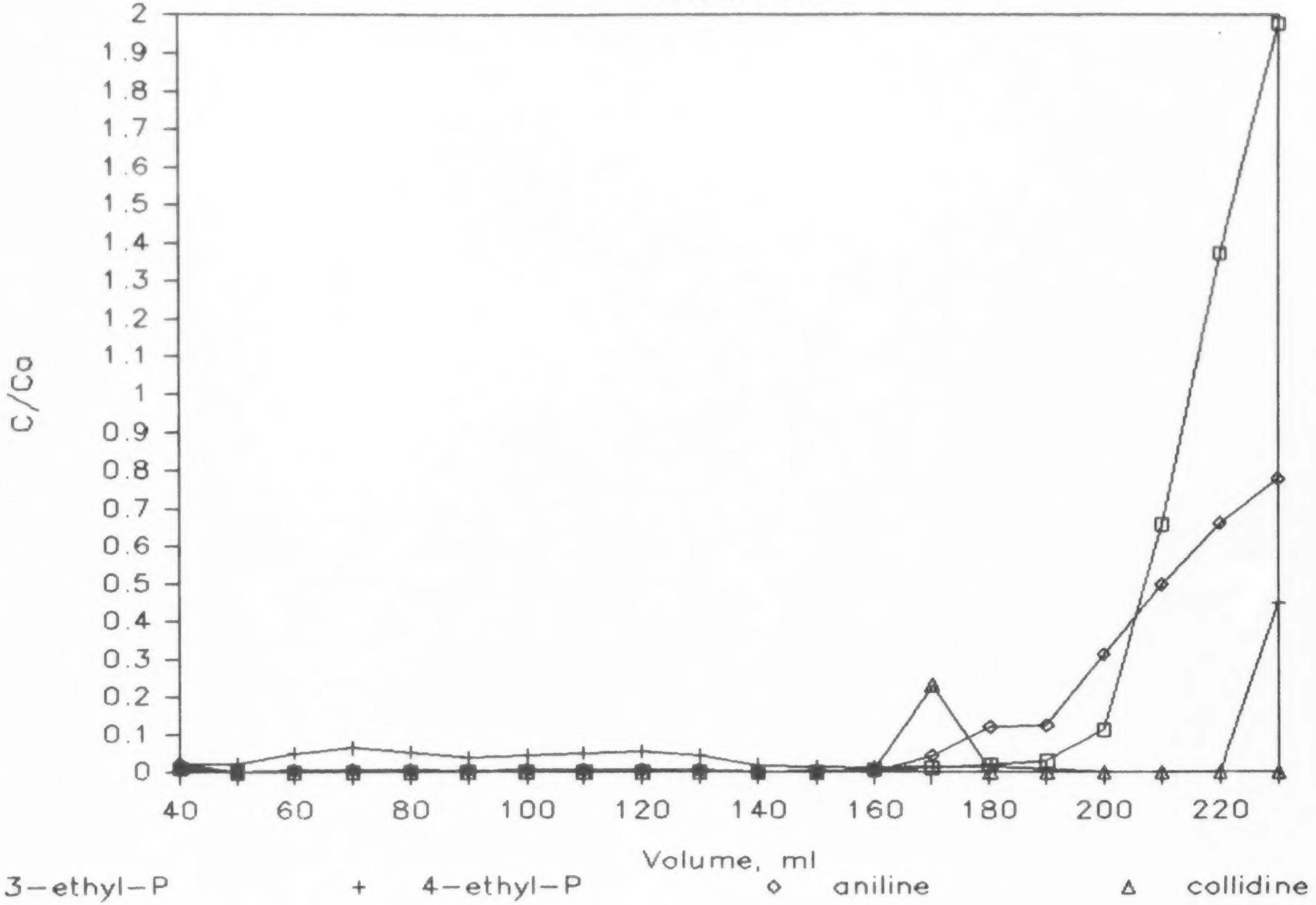
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-67

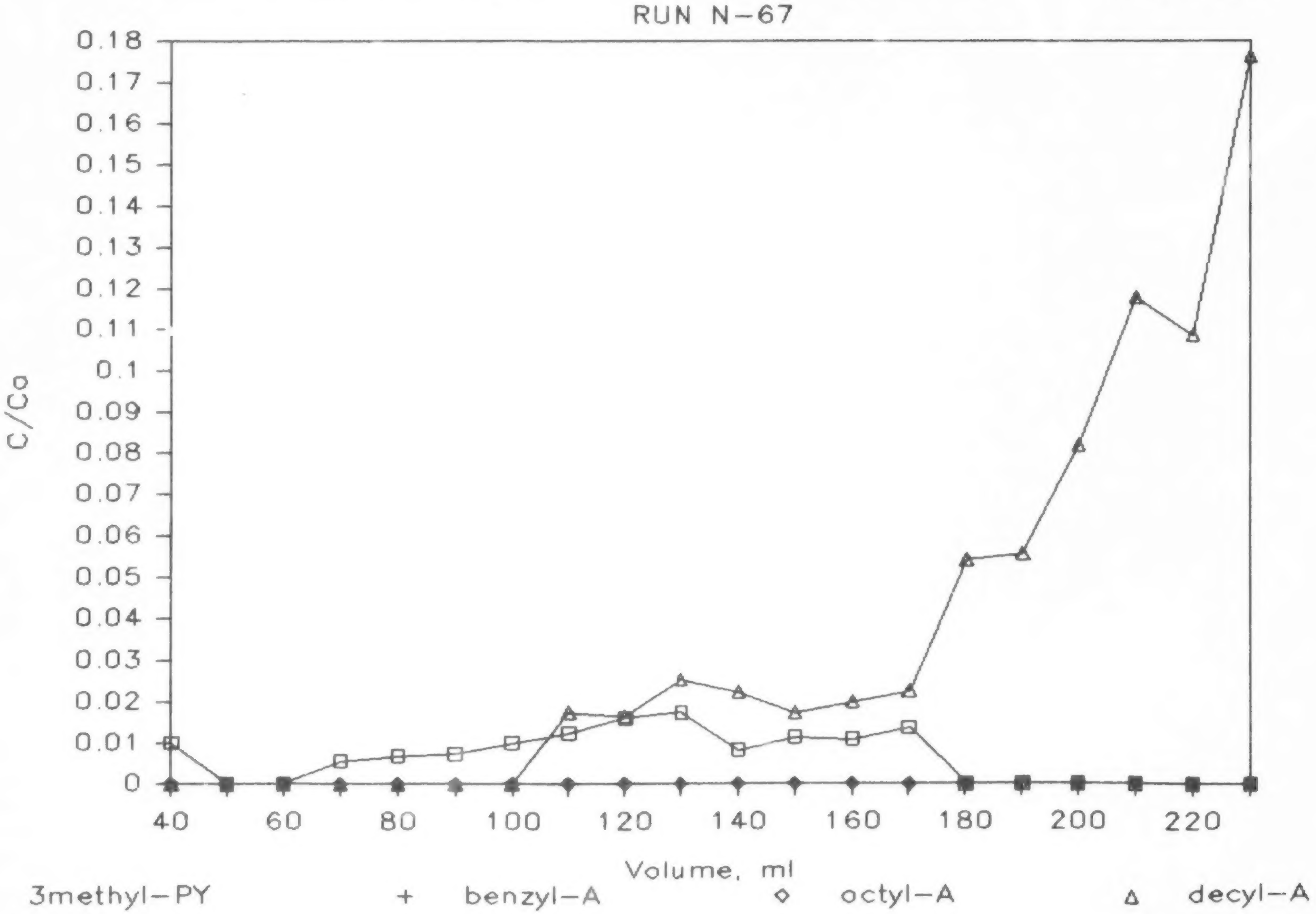


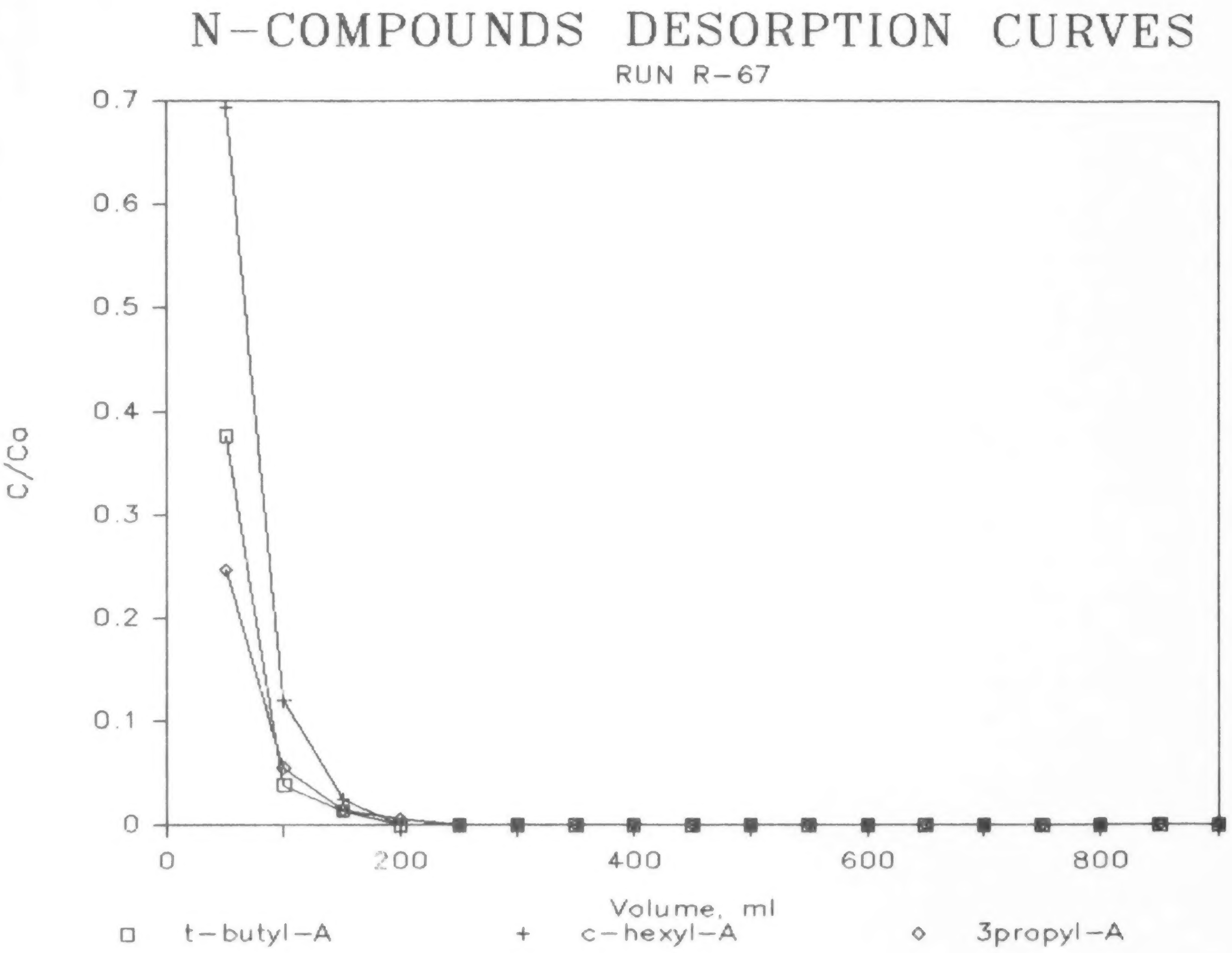
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-67



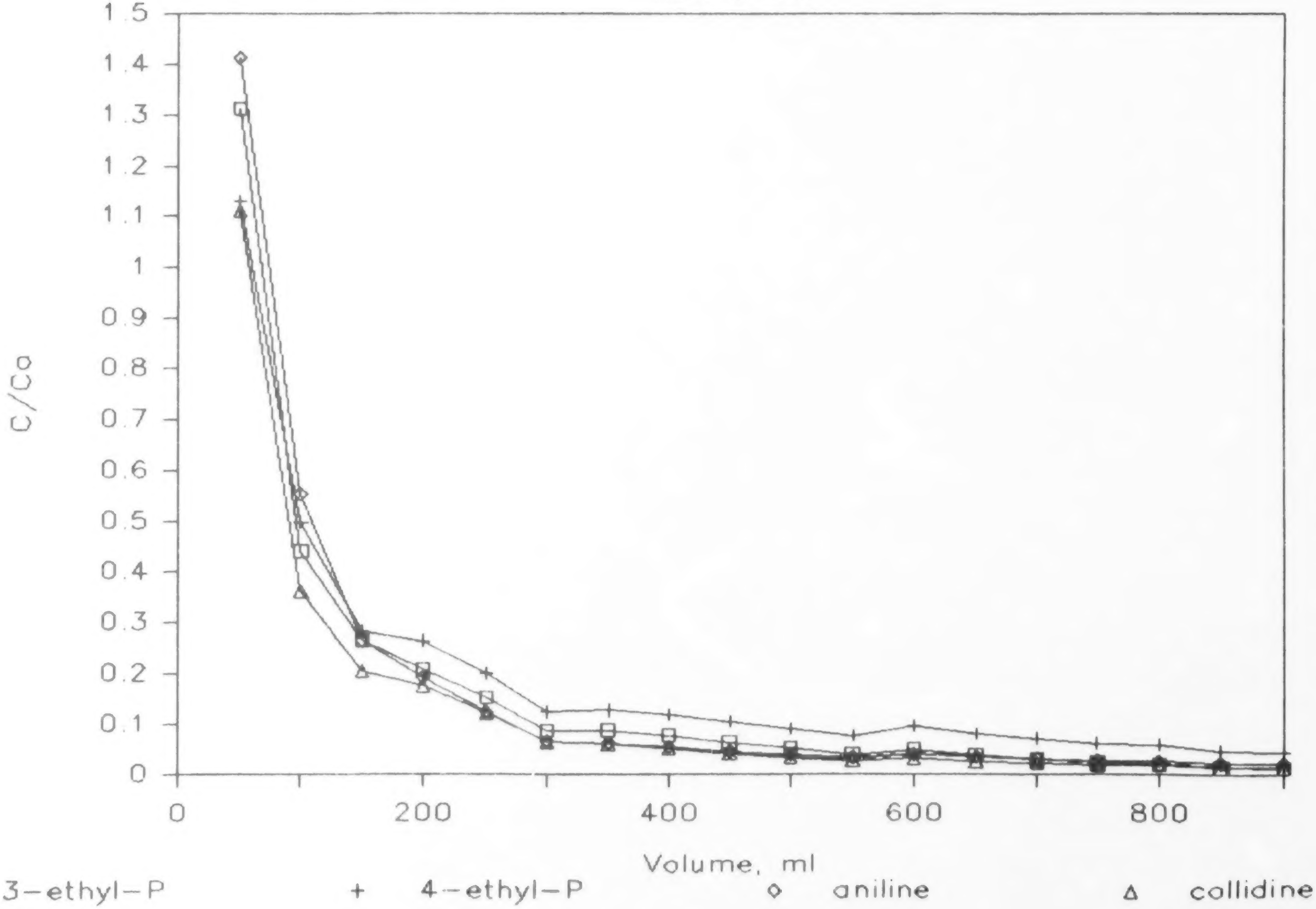
N-COMPOUNDS BREAKTHROUGH CURVES




N-COMPOUNDS DESORPTION CURVES
RUN R-67
C/Co
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
200
400
600
800
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

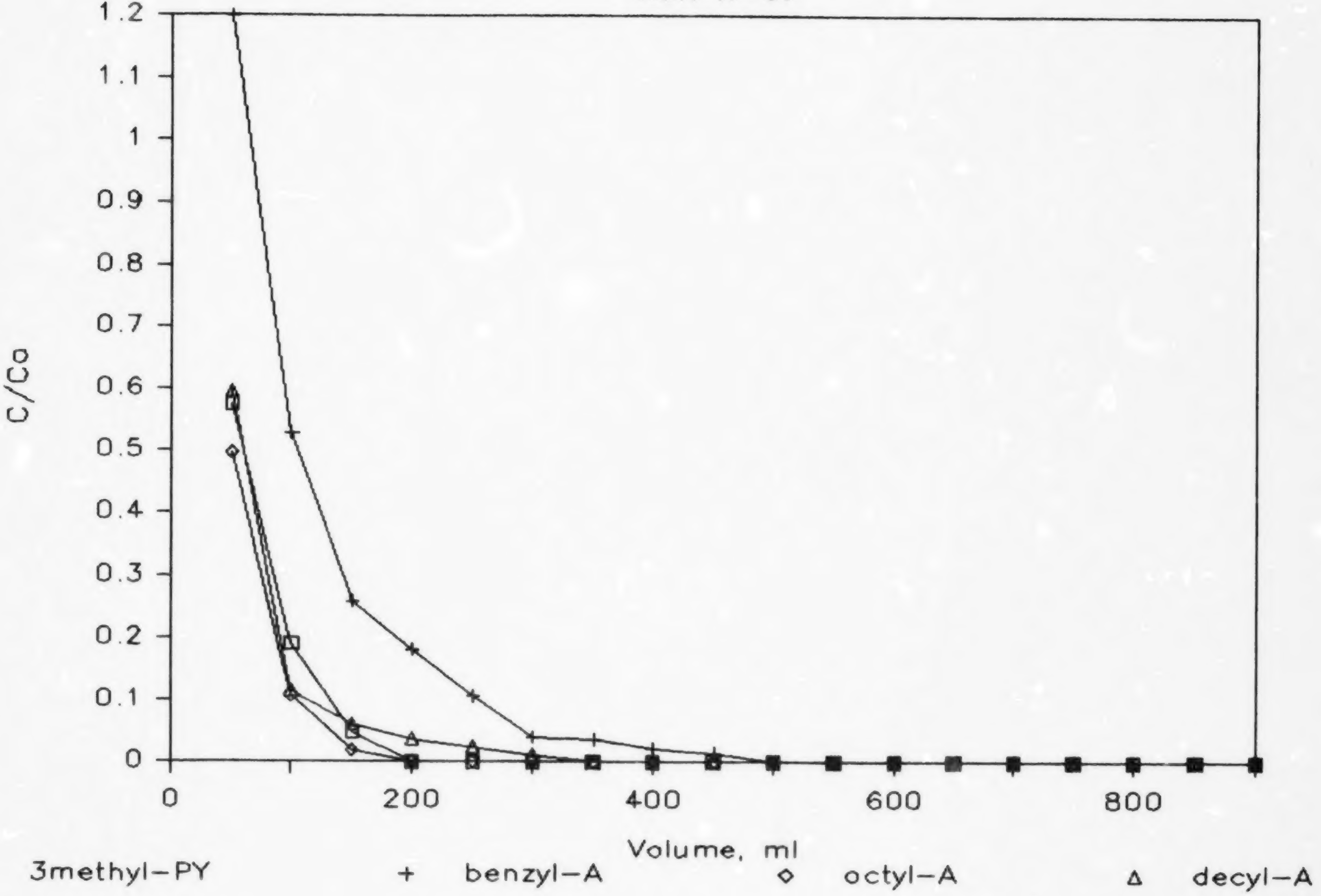
N-COMPOUNDS DESORPTION CURVES

RUN R-67



N-COMPOUNDS DESORPTION CURVES

RUN R-67



Run N-63: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0	0	0	0	0	0	0	0	0	0	0
4	40	0	0	0	0	0	0	0	0	0	0	0
5	50	0.15277543	0.00813424	0	0.00747374	0.08043747	0.05018224	0.03986176	0.01671712	0.01888310	0.02165401	0.10250153
6	60	0.02244847	0	0	0.02487458	0.05696231	0.01967371	0.02065553	0.00409075	0.01479046	0	0.02693755
7	70	0.02550095	0	0	0.00882810	0.11025433	0.01843669	0.01023164	0	0.08227001	0	0.02480805
8	80	0.02947093	0	0	0.00800046	0.12181320	0.01846165	0.00672990	0	0.09194706	0	0.03144359
9	90	0.02038071	0	0	0.00815353	0.09998190	0.01476682	0.00556804	0.00385167	0.15342383	0	0
10	100	0.03244969	0	0	0.00359576	0.06621611	0.00925446	0.00200336	0.00479737	0.14224710	0	0.00982800
11	110	0.02031279	0	0	0	0.06629488	0.00775487	0.00262923	0.00385951	0.09158783	0	0
12	120	0.01640461	0	0	0.00860968	0.05374541	0.00676253	0.00366321	0.01216248	0.13673010	0	0.01978158
13	130	0.02959416	0	0	0.01172530	0.05117218	0.01415350	0.00778566	0.01796865	0.13395311	0	0.01724637
14	140	0.03782086	0	0.00346921	0.00645370	0.03204284	0.00878787	0.00935272	0.01485166	0.08229840	0	0.01854388
15	150	0.02844794	0	0.00377708	0.00970332	0.01464481	0.01654556	0.00731464	0.01124144	0.03443517	0	0.02426497
16	160	0.04153407	0.03767037	0.00219112	0.00560532	0.00794580	0.00870389	0.00671145	0.00796976	0.02821403	0.02256925	0.05554316
17	170	0.60993894	0.03278945	0.01230252	0.01072276	0.01608904	0.00766303	0.02500610	0.01825864	0.01222916	0.02100829	0.04120959
18	180	0.95844075	0.02307412	0.01144653	0.00914082	0.01170761	0.07314056	0.82593086	0.00720822	0.01182464	0.01141552	0.04894010
20	200	0.99341775	0	0.00897693	0.01055258	0.00489774	0.23380545	0	0	0	0	0.04523876
21	210	1.19412325	0	0.01019474	0.08930460	0.00985169	0.56380532	0	0	0	0	0.05434614
22	220	1.15813820	0	0.01498090	0.89757369	0.01742940	0.71804273	0	0	0	0	0.07172617
23	230	0.93949511	0.02617030	0.01762705	1.72596124	0.06724558	0.83429606	0	0	0.00505917	0	0.10084282
24	240	0.68979067	0.06986070	0.01773596	1.81207280	0.13621006	0.91809849	0	0	0.01340654	0	0.12292628

Run N-63: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	10		877948
2	20		
3	30		
4	40		
5	50	847046	
6	60	908314	
7	70	973329	
8	80	994196	
9	90	914926	
10	100	886518	
11	110	925554	
12	120	941210	
13	130	903318	
14	140	1172360	
15	150	973602	
16	160	1237100	
17	170	858788	
18	180	879219	
20	200	914302	
21	210	1000610	
22	220	975340	
23	230	997013	
24	240	953829	

Run R-63: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	1.00856139	0.17146761	1.44853923	1.15949966	2.71265609	1.72310474	0.47087709	2.15620045	0.64323622	0.47007865
2	100	0	0.10763887	0.05771836	0.74948959	1.00704505	0.59798746	0.43813270	0.16123313	0.62231164	0.07386066	0.06650245
3	150	0	0.04453423	0.03014513	0.20427184	0.36091508	0.15854286	0.12226632	0.05991206	0.13134349	0.01885660	0.00776167
4	200	0	0.03171083	0.02910518	0.11708941	0.23344183	0.10316460	0.08059901	0.03121919	0.04986292	0.01322999	0.01914074
5	250	0	0.02491934	0.02387323	0.08788275	0.15981269	0.05659094	0.05672677	0.01934884	0.02415009	0.01451492	0.00760552
6	300	0	0.01869103	0.01412336	0.06193197	0.10331926	0.02849786	0.03335395	0.01136946	0.01288302	0.00482984	0.00581097
7	350	0	0.02218264	0.01289671	0.06108997	0.10142587	0.02317330	0.02824290	0.00976566	0.00871361	0.00635331	0.01132604
8	400	0	0.01998317	0.00866445	0.04459258	0.07851501	0.01580409	0.01939031	0.00689412	0.00597596	0	0
9	450	0	0.01307317	0.00408865	0.02468607	0.04727525	0.00905541	0.01074628	0.00425197	0	0	0
10	500	0	0.01783588	0.00468618	0.02706336	0.05531757	0.01013844	0.01166551	0.00465645	0	0	0
11	550	0	0.01401769	0.00283282	0.01813047	0.04038283	0.00759275	0.00805728	0.00369457	0	0	0
12	600	0	0.01431466	0.00249644	0.01561823	0.03742192	0.00618569	0.00701032	0.00340279	0	0	0
13	650	0	0.01639678	0.00266350	0.01500718	0.03833729	0.00649662	0.00676978	0.00347322	0	0	0
14	700	0	0.01029450	0	0.00846713	0.02347434	0.00425104	0.00413222	0	0	0	0
15	750	0	0.01174255	0	0.00870691	0.02517014	0.00525133	0.00437971	0	0	0	0
16	800	0	0.01490541	0	0.00991240	0.03007184	0.00552584	0.00497897	0	0	0	0
17	850	0	0.00961164	0	0.00588552	0.01897913	0.00386960	0.00297714	0	0	0	0
18	900	0	0.02037889	0.00263609	0.01005606	0.02624116	0.00742316	0.00574646	0.01102737	0	0	0

Run R-63: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

#	ml	Toluene-S	Toluene-F
1	50	828722	877981
2	100	132195	
3	150	54477.6	
4	200	35071.5	
5	250	21702.7	
6	300	11300.2	
7	350	11446	
8	400	6685.44	
9	450	4258.87	
10	500	5722.44	
11	550	3723.08	
12	600	3903.53	
13	650	4766.34	
14	700	2759.07	
15	750	3217.41	
16	800	4044.44	
17	850	2156.11	
18	900	66164.8	

Run N-68: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0	0	0	0
2	20	0	0	0	0	0	0	0	0	0	0	0
3	30	0.08396384	0	0.02925285	0.02296855	0.08607295	0.04938281	0.03285074	0.04095466	0.02244748	0.01706471	0.03047365
4	40	0.12812477	0	0.01132512	0	0	0.02845409	0.01118983	0.01604663	0.01142102	0	0
5	50	0.00901127	0	0.00622023	0	0	0.01273380	0	0	0	0	0
6	60	0.01592507	0	0.00581814	0	0	0.01106346	0	0.00508743	0	0	0
7	70	0.00897896	0	0.00617357	0	0	0.01003227	0	0.00656770	0	0	0
8	80	0.00749854	0	0.00477493	0	0	0.00873201	0	0.00840449	0	0	0.01048263
9	90	0.00827388	0	0	0	0	0.00815081	0	0.00926701	0	0	0.01248404
10	100	0	0	0	0	0	0.00593940	0	0.00884734	0	0	0.01375338
11	110	0.01001757	0	0	0	0	0.00502586	0	0.00858132	0	0	0.01497513
12	120	0.00637463	0	0	0	0	0.00629152	0	0.01085849	0	0	0.01904703
13	130	0	0	0	0	0	0	0.00362534	0.00821672	0	0	0.02026864
14	140	0.44658931	0	0.00441652	0.00981549	0.00709347	0	0.01142211	0.00529306	0	0	0.03433395
15	150	2.21049632	0	0	0.01091059	0.01333536	0.00850465	0.01855622	0.00848240	0	0	0.02710708
16	160	1.79480873	0	0	0.01496845	0.01082240	0.06063933	0	0	0	0	0.05088834
17	170	1.73294845	0	0.00778765	0.01661019	0.00891203	0.38787109	0	0	0	0	0.09608299
18	180	1.25781095	0	0.00661537	0.03858165	0.01468836	0.69303498	0	0	0	0.01499268	0.10517202
19	190	0.67622406	0	0.00664637	0.12900212	0.04776851	0.75211388	0	0	0	0.02758002	0.16146094
20	200	0.97854486	0	0.00486121	0	0	0.74960937	0	0	0	0.01542722	0.12618802
21	210	0.70420377	0	0.00559293	0	0	1.07855159	0	0	0	0.01779849	0.18802389
22	220	0.78743642	0.08473156	0.00937409	2.10545744	0.41045237	0.94189494	0	0	0	0.03288122	0.20230803
23	230	0.62374930	0.34525580	0.02053007	2.26305836	0.63844755	1.02940569	0	0	0	0.02122864	0.24301589
24	240	0.59245745	0.54847454	0.03058877	1.75748929	0.66790225	0.82582779	0	0	0	0.03226886	0.17470390
25	DEP	0.50946642	0.41946870	0.05074561	1.21751078	0.74685570	0.67878228	0	0	0	0.01527912	0.12463643

Run N-68: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	10		596997
2	20		
3	30	987552	
4	40	1022390	
5	50	1024120	
6	60	1096060	
7	70	1027490	
8	80	1143450	
9	90	1266860	
10	100	1170620	
11	110	1199210	
12	120	1240430	
13	130	1080000	
14	140	1345230	
15	150	1021580	
16	160	936504	
17	170	971418	
18	180	848960	
19	190	875715	
20	200	934362	
21	210	873389	
22	220	903359	
23	230	891115	
24	240	897146	
25	DEP	916835	

n R-68: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	1.00882075	0.32761816	2.98456680	2.98375202	2.74525682	1.68207966	0.63679842	3.23856337	0.57195112	0.53751518
2	100	0	0.37538358	0.11500418	1.20557346	1.57643198	0.88662426	0.67391101	0.23630404	0.60662087	0.09007945	0.16965323
3	150	0	0.15022815	0.04240823	0.33550573	0.56673827	0.24901907	0.18942733	0.06350960	0.08258270	0.02306581	0.02102466
4	200	0	0.09104452	0.02593799	0.13451993	0.26785386	0.10523171	0.08542764	0.03728249	0.01574650	0	0
5	250	0	0.08717953	0.01664795	0.08856221	0.18088242	0.06007397	0.05284429	0.02122281	0	0	0
6	300	0	0.06363035	0.00945676	0.05031026	0.10310053	0.02798706	0.02822609	0.01108901	0	0	0
7	350	0	0.04623152	0.00506523	0.02699293	0.06460852	0.02105940	0.01769717	0.00751645	0	0	0
8	400	0	0	0	0.02930199	0.08137432	0.03633108	0.02303771	0.00854549	0	0	0
9	450	0	0	0	0.01253153	0.04903819	0.01429856	0.01079483	0	0	0	0
10	500	0	0	0	0.00810731	0.03701919	0.01338564	0.00771391	0	0	0	0
11	550	0	0	0	0	0.02368714	0.00748294	0.00499101	0	0	0	0
12	600	0	0	0	0	0.02117253	0.00757835	0.00459033	0	0	0	0
13	650	0	0	0	0	0.01594037	0.00632834	0.00377776	0	0	0	0
14	700	0	0	0	0	0.01343792	0.00582931	0.00341685	0	0	0	0
15	750	0	0	0	0	0.00946155	0	0	0	0	0	0
16	800	0	0	0	0	0.00804135	0	0	0	0	0	0
17	850	0	0	0	0	0	0	0	0	0	0	0
18	900	0	0	0	0	0	0	0	0	0	0	0

Run R-68: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

#	ml	Toluene-S	Toluene-F
1	50	369618	596997
2	100	109994	
3	150	41363.2	
4	200	22209.5	
5	250	12346	
6	300	9270.83	
7	350	29801.2	
8	400	24618.9	
9	450	22917.8	
10	500	22011.2	
11	550	20784.2	
12	600	21298	
13	650	20232.5	
14	700	21077.2	
15	750	20367.5	
16	800	20794.7	
17	850	19535.3	
18	900	20856.9	

Run N-69: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	10	0	0	0	0	0	0	0	0		0	0
2	20	0	0.41370234	0.30930582	0.20096722	0.44240860	0.28200661	0.19202862	0.25643557	0	0.47908546	0.30342188
3	30	1.79445641	0.01324797	0.33743710	0.06954130	0.78564580	0.13826814	0.00409699	0.05195781	0	1.11427516	0.22853876
4	40	1.61863268	0	0.17509224	0	0.34524962	0.04522001	0	0.01244020	0	2.52277105	1.15429829
5	50	0.59675836	0	0.12192137	0	0.20534461	0.02545046	0	0.01010919	0	3.28509660	1.36504525
6	60	0.58901938	0	0.06507443	0	0.10109311	0.01116391	0	0.01060149	0	2.76910257	0.90070336
7	70	0.63942367	0	0.03709483	0	0.05763014	0.00715987	0	0.00954980	0	2.16832301	0.50046384
8	80	0	0	0.02744208	0	0.05553853	0.00769763	0	0.01608796	0	2.01882217	0.33278548
9	90	0	0	0.01499777	0	0.04902607	0.00708670	0	0.01905902	0	1.31657803	0.17273099
10	100	0	0	0.01140537	0	0.04510677	0.00878328	0	0.02286694	0	0.72426670	0.13532672
11	110	0	0	0.01645548	0.00515880	0.02322452	0.00923841	0.01175259	0.01455403	0	0.05564529	0.02899342
12	120	0.16927799	0	0.01796328	0.00586685	0.01440252	0	0.01105628	0.00926390	0	0.02170187	0.07930914
13	130	0.11555578	0	0.01769442	0.00654244	0.00953452	0	0.00653160	0.00857402	0	0.00931553	0.02013252
14	140	0.48274695	0	0.01858699	0.01047043	0.01212863	0.01644494	0.01972292	0.02019328	0	0.00961797	0.05236256
15	150	0.62493287	0	0.01530729	0.01782753	0.01194542	0.05602155	0.68127589	0.03433533	0	0.01687017	0.06400426
16	160	0.53640179	0	0.00848117	0.02173442	0.00689806	0.11343534	0	0	0	0.01240032	0.06458952
17	170	0.54774544	0	0.01438184	0.04055398	0.01647322	0.31933804	0	0	0	0.12738865	0.11350062
18	180	0.50993883	0	0.01792938	0.24250866	0.03707346	0.55915784	0	0	0	0.09810744	0.08879231
19	190	0.41616882	0	0.02378732	1.07411821	0	0.62334665	0	0	0	0.29081283	0.1813281
20	200	0.50301197	0	0.02460788	1.93987122	0	0.72262679	0	0	0	0.02243413	0.07952400
21	210	0.43802818	0	0.04201186	2.08066508	0.33121665	0.82363684	0	0	0	0.40204631	0.20363456
22	220	0.56998517	0.06578667	0.05298575	2.28369049	0.59358528	0.90856838	0	0	0	0.43599550	0.26610910
23	230	0.50798067	0.06803315	0.02061228	1.60636548	0.58124220	0.69481294	0	0	0	0.32008824	0.20552624
24	240	0.66092824	0.18878711	0.03633498	2.37194276	1.21030090	1.01713402	0	0	0	0.42116196	0.26308941
25	DEP	0.54561047	0.13389941	0.05194958	1.89535639	1.21227983	0.83823441	0	0	0	0.42488781	0.27961345

Run N-69: 13X/Carbon RZN-1/Montmorillonite, 1 ml/min, 15 psi, 250 C, Standard solution 1000 ppm

#	ml	Toluene-S	Toluene-F
1	10		596997
2	20	697102	
3	30	868262	
4	40	773863	
5	50	808786	
6	60	788177	
7	70	740801	
8	80	847403	
9	90	709142	
10	100	762483	
11	110	786665	
12	120	842554	
13	130	647195	
14	140	619875	
15	150	697855	
16	160	755481	
17	170	761771	
18	180	764939	
19	190	729414	
20	200	780348	
21	210	809873	
22	220	923518	
23	230	697036	
24	240	1118830	
25	DEP	735254	

Run R-69: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

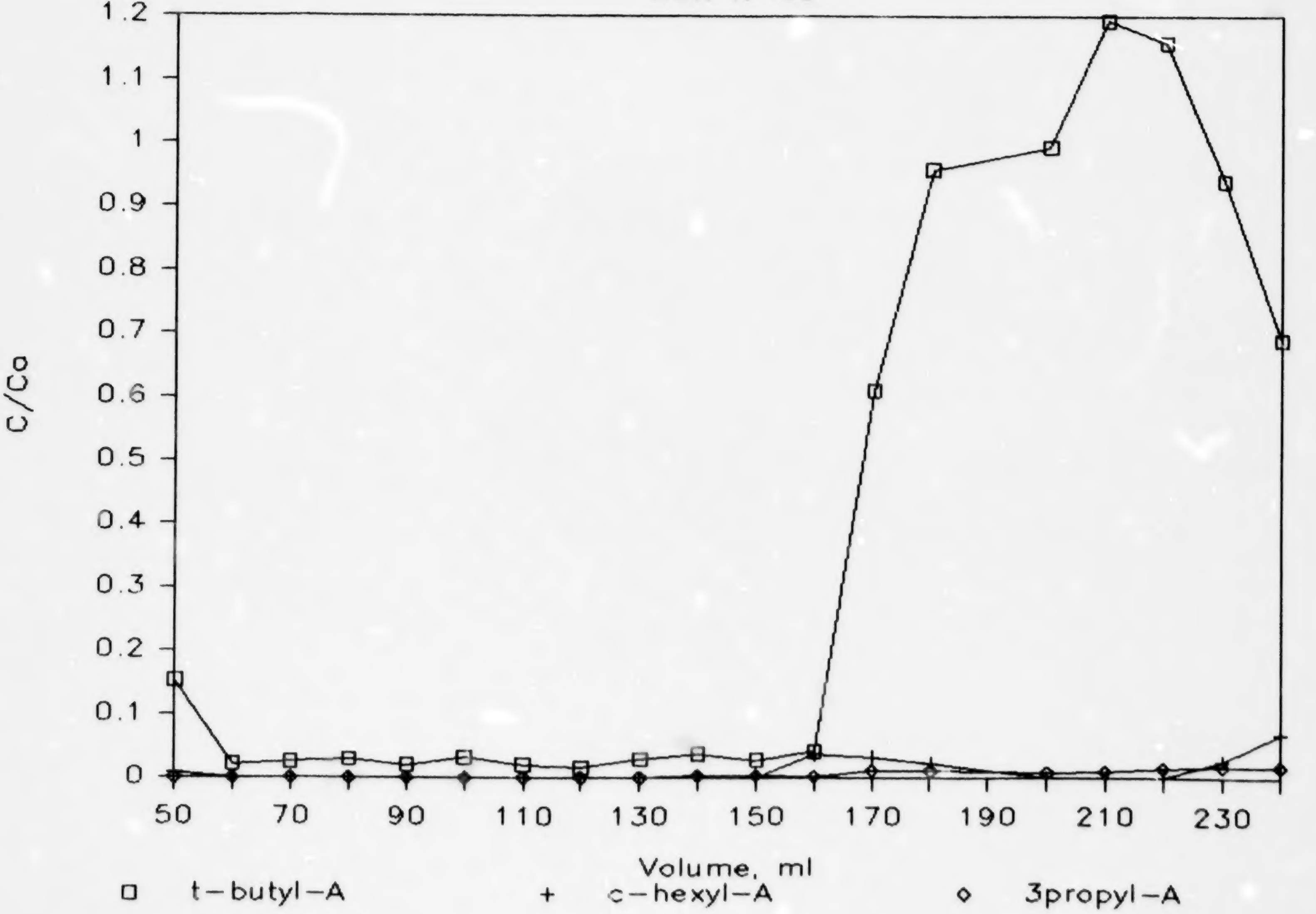
							C/Co					
#	ml	t-butyl-A	c-hexyl-A	3propyl-A	3-ethyl-P	4-ethyl-P	Aniline	Collidine	3methyl-PY	benzyl-A	octyl-A	decyl-A
1	50	0	0.94284032	0.48429358	3.52021557	3.31896587	3.13987903	1.89112382	0.02277754	4.01928728	0.44936432	0.38096393
2	100	0	0.12370381	0.03381328	0.64230644	1.07188193	0.50721875	0.31821449	0.12358087	0.26946817	0.05942010	0.24651424
3	150	0	0.06227494	0.01904893	0.20898722	0.46853419	0.20162379	0.12705072	0.04033609	0.05853231	0	0.05921936
4	200	0	0.03269939	0.00989606	0.07460047	0.18174724	0.06568802	0.05211396	0.01665700	0.03644154	0	0.02058051
5	250	0	0.04119029	0.00877759	0.07684459	0.18132310	0.06386314	0.04936571	0.01854059	0.04834822	0	0.01774321
6	300	0	0.03212843	0.00613699	0.04945244	0.12221044	0.04277683	0.03080507	0.01333052	0.03937784	0	0.01314428
7	350	0	0.02333309	0	0.02869720	0.08287596	0.03004677	0.01991859	0.00881618	0.03132616	0	0.00840812
8	400	0	0.02090321	0	0.02125127	0.07047854	0.02593958	0.01667776	0.00786096	0.03183415	0	0.00822384
9	450	0	0	0	0.01537185	0.05377319	0.02360590	0.01417486	0.00662387	0.02612697	0	0.00697569
10	500	0	0	0	0.00988812	0.04146897	0.01782062	0.01078187	0.00540916	0.02380095	0	0
11	550	0	0	0	0.00788591	0.03603338	0.01571199	0.00940869	0	0.01991682	0	0
12	600	0	0	0	0	0.02205827	0.01066302	0.00638976	0	0.01259337	0	0
13	650	0	0	0	0	0.02134516	0.01491614	0.00682502	0	0.01429897	0	0
14	700	0	0	0	0	0.01499871	0.00968942	0.00754864	0.00555681	0.03638685	0	0
15	750	0	0	0	0	0	0	0	0	0	0	0
16	800	0	0.02953837	0.01070701	0.03876442	0.04245616	0.02692052	0.04122748	0.07876900	0	0	0.01013554
17	850	0	0	0	0.02357891	0.03154400	0.02899245	0.03064911	0.00979824	0.08146201	0.00352272	0.02361600
18	900	0	0	0	0.02076582	0.03412529	0.05410522	0.02905722	0.00119166	0.03224473	0	0.02101865

Run R-69: 13X/Carbon RZN-1/Montmorillonite, 5 ml/min, Atmospheric pressure, 250 C, Isopropanol as regeneration solvent

#	ml	Toluene-S	Toluene-F
1	50	343121	596997
2	100	39802.1	
3	150	18205.3	
4	200	8590.52	
5	250	8716.22	
6	300	6284.77	
7	350	4390.28	
8	400	3732.18	
9	450	2870.03	
10	500	2547.78	
11	550	2645.36	
12	600	2498.98	
13	650	3335.07	
14	700	10103	
15	750	27269.3	
16	800	43964.9	
17	850	10544.7	
18	900	5169.07	

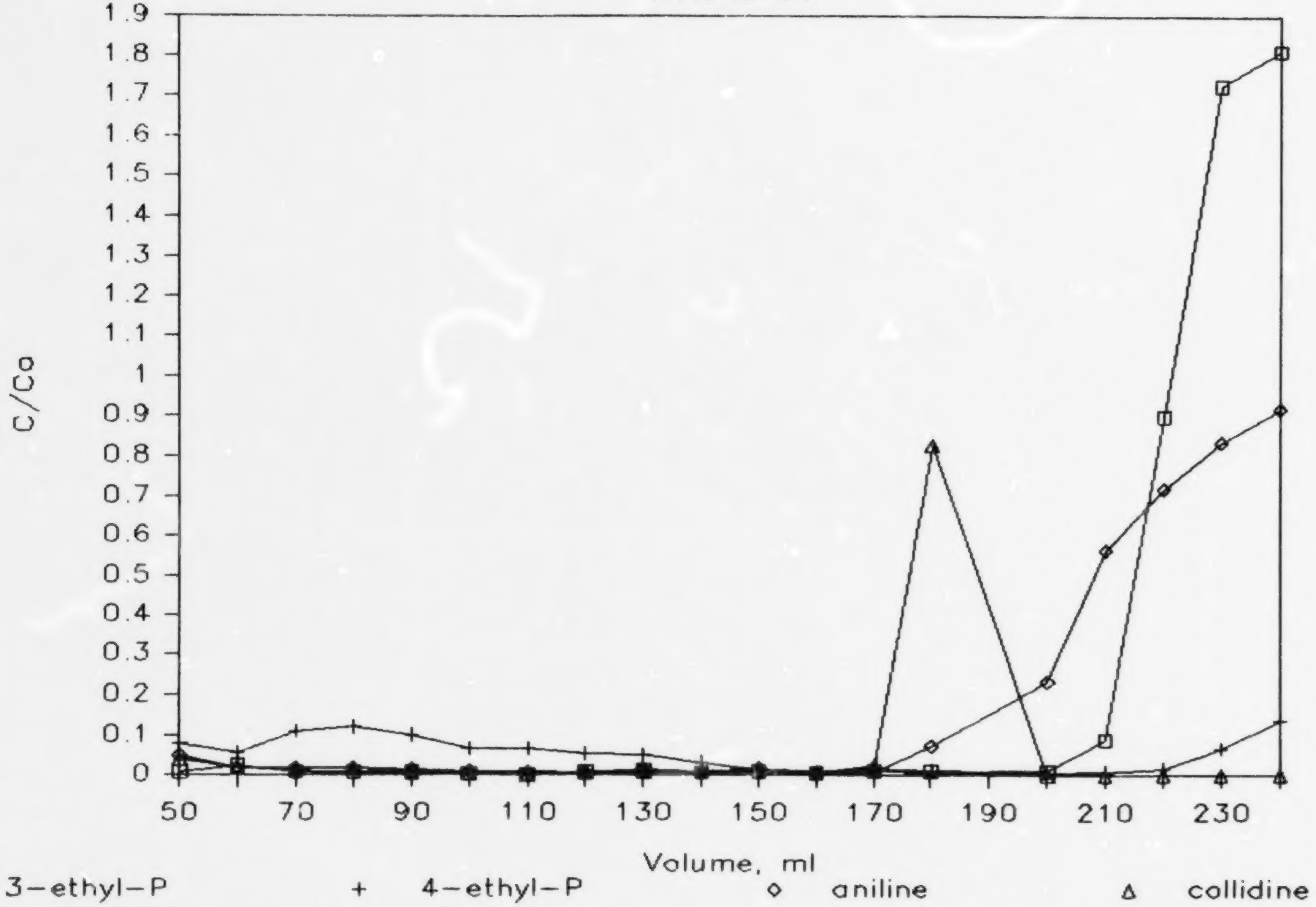
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–63



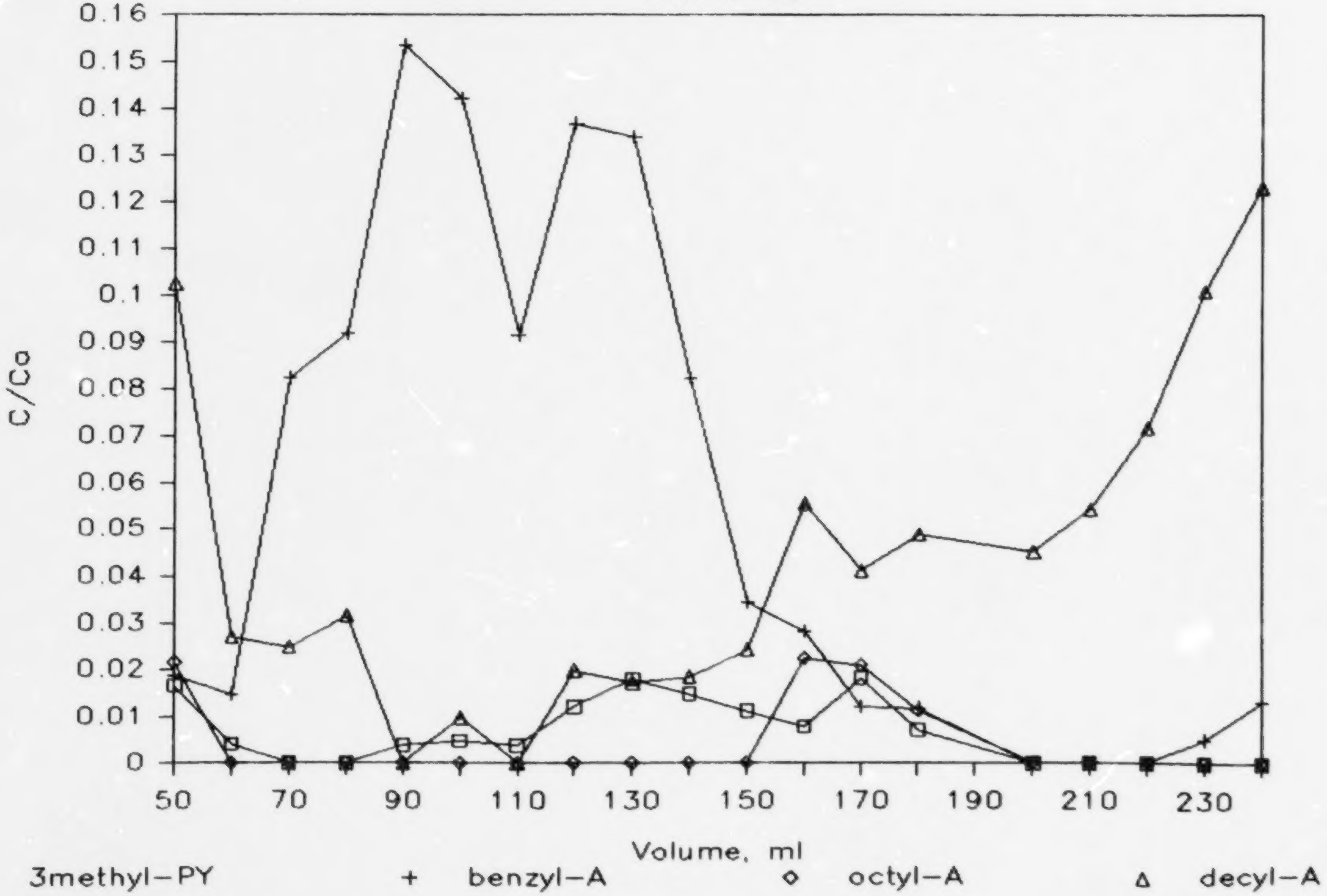
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-63



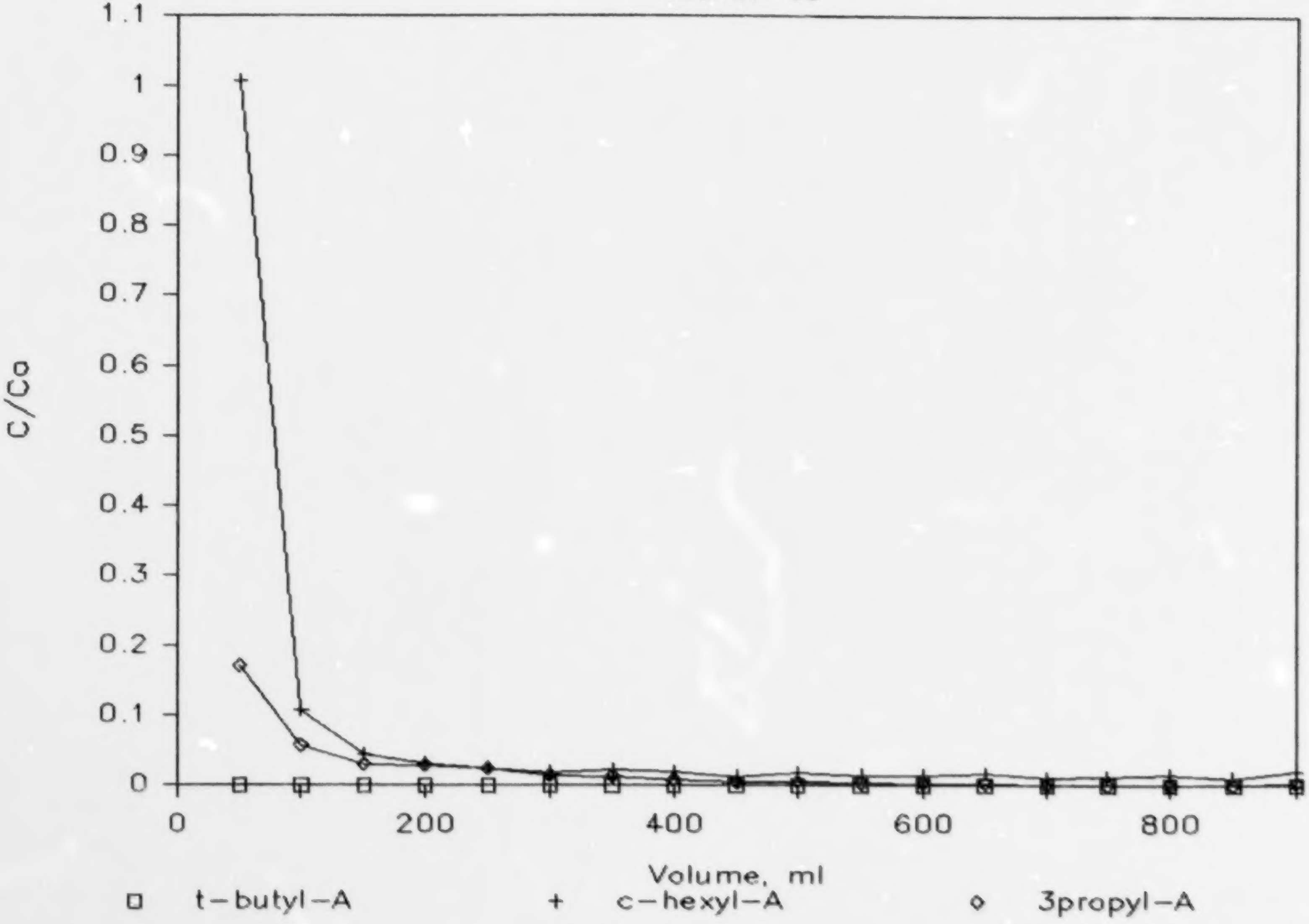
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–63



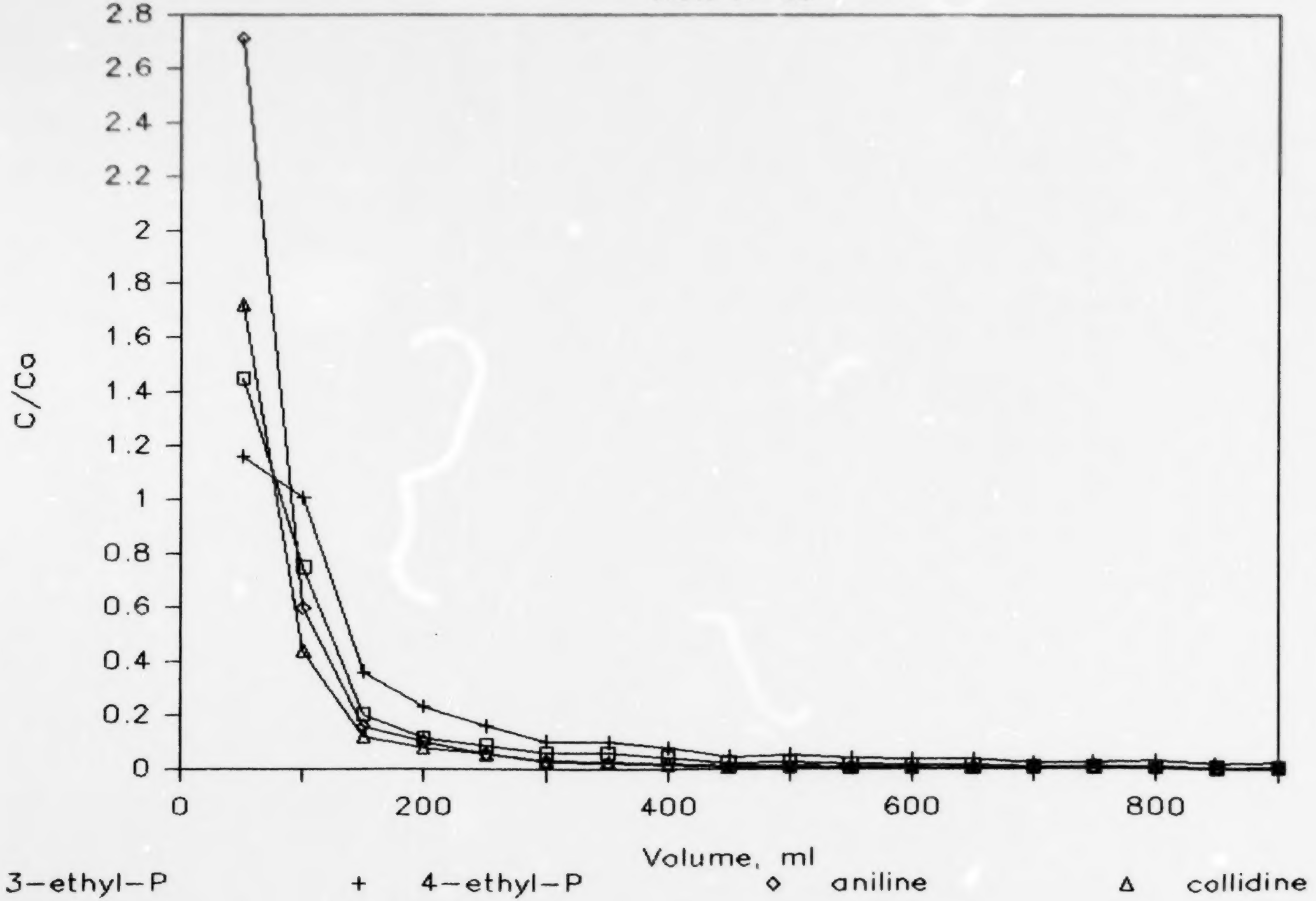
N-COMPOUNDS DESORPTION CURVES

RUN R-63



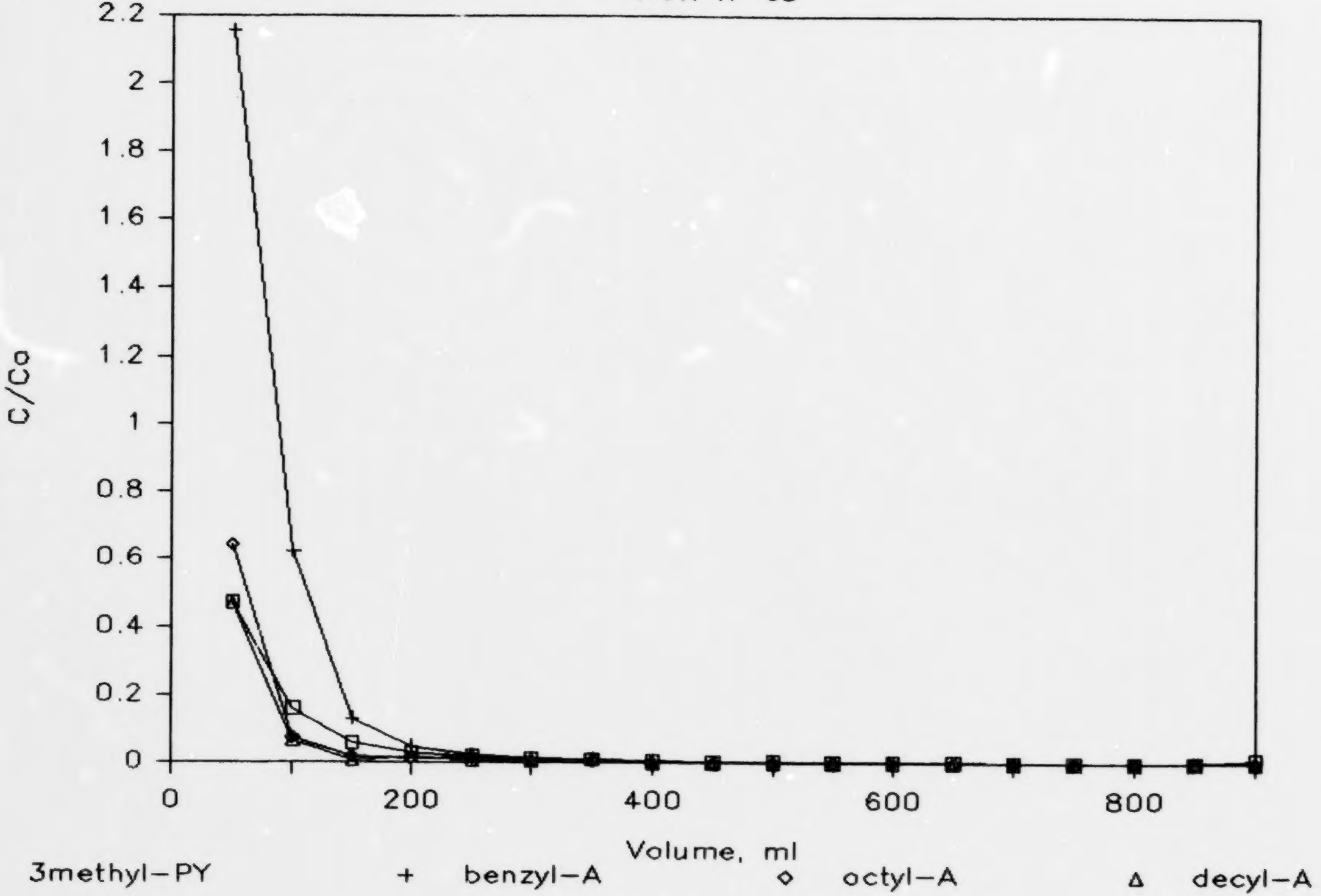
N–COMPOUNDS DESORPTION CURVES

RUN R–63



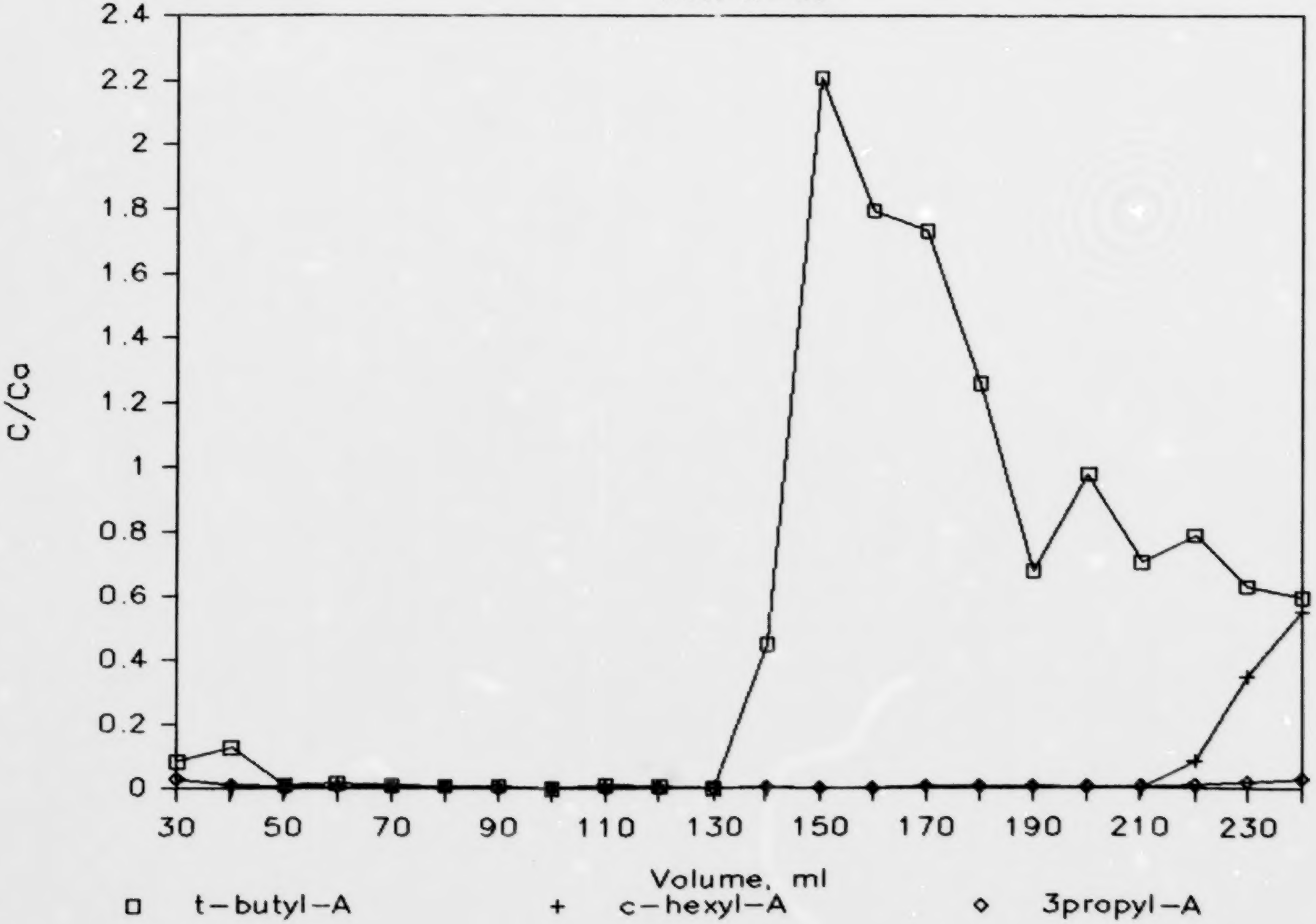
N-COMPOUNDS DESORPTION CURVES

RUN R-63



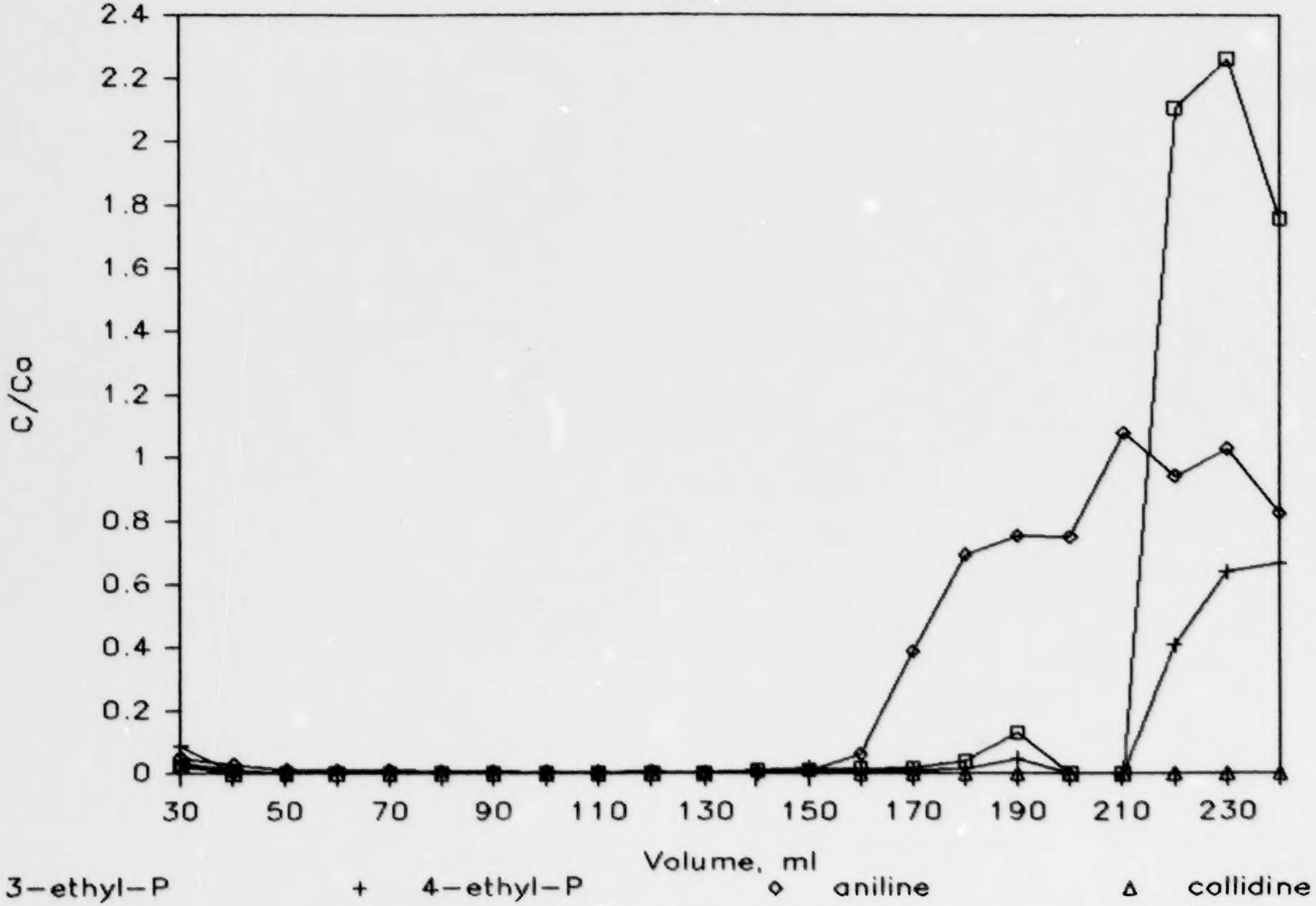
N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–68

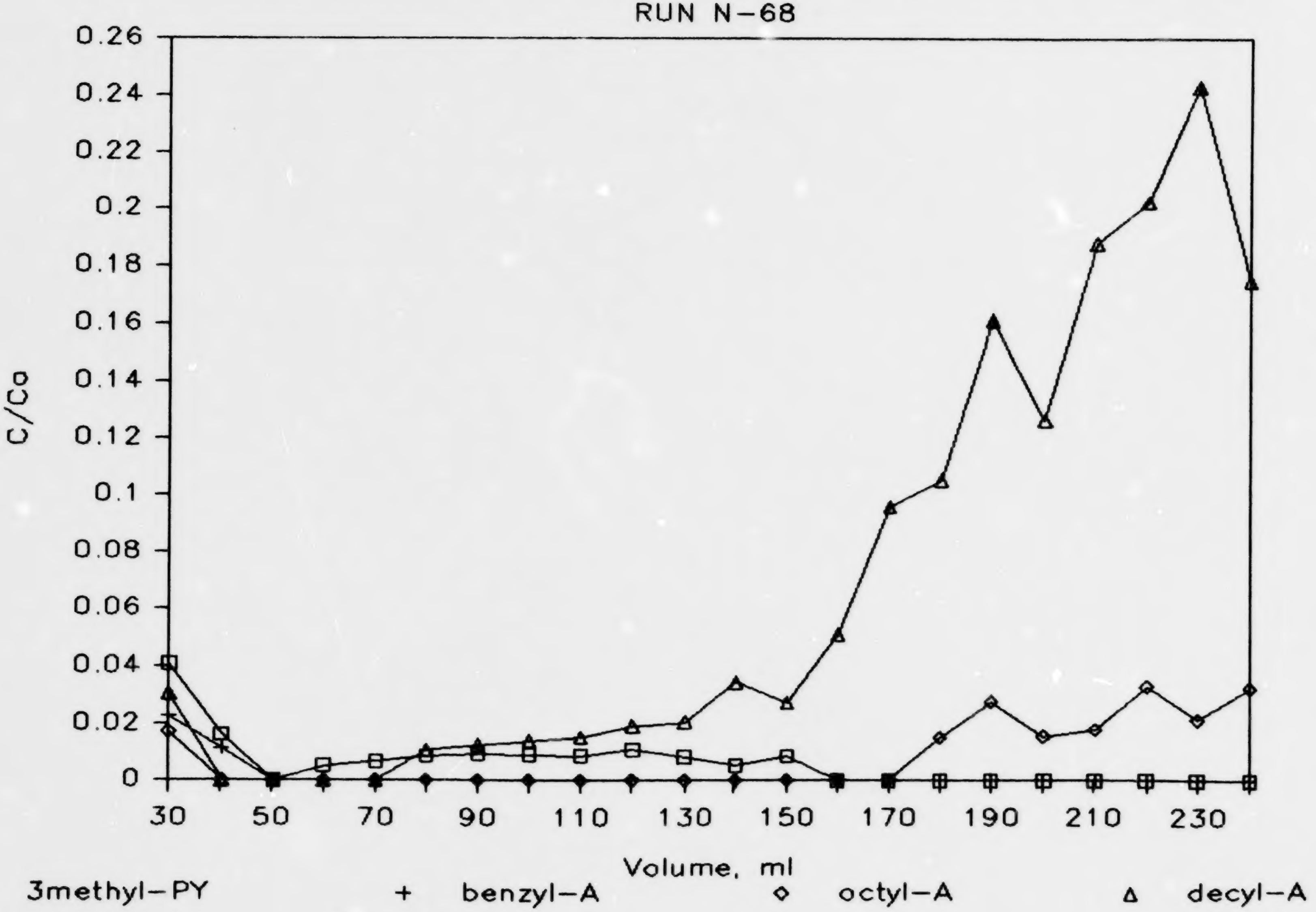


N–COMPOUNDS BREAKTHROUGH CURVES

RUN N–68

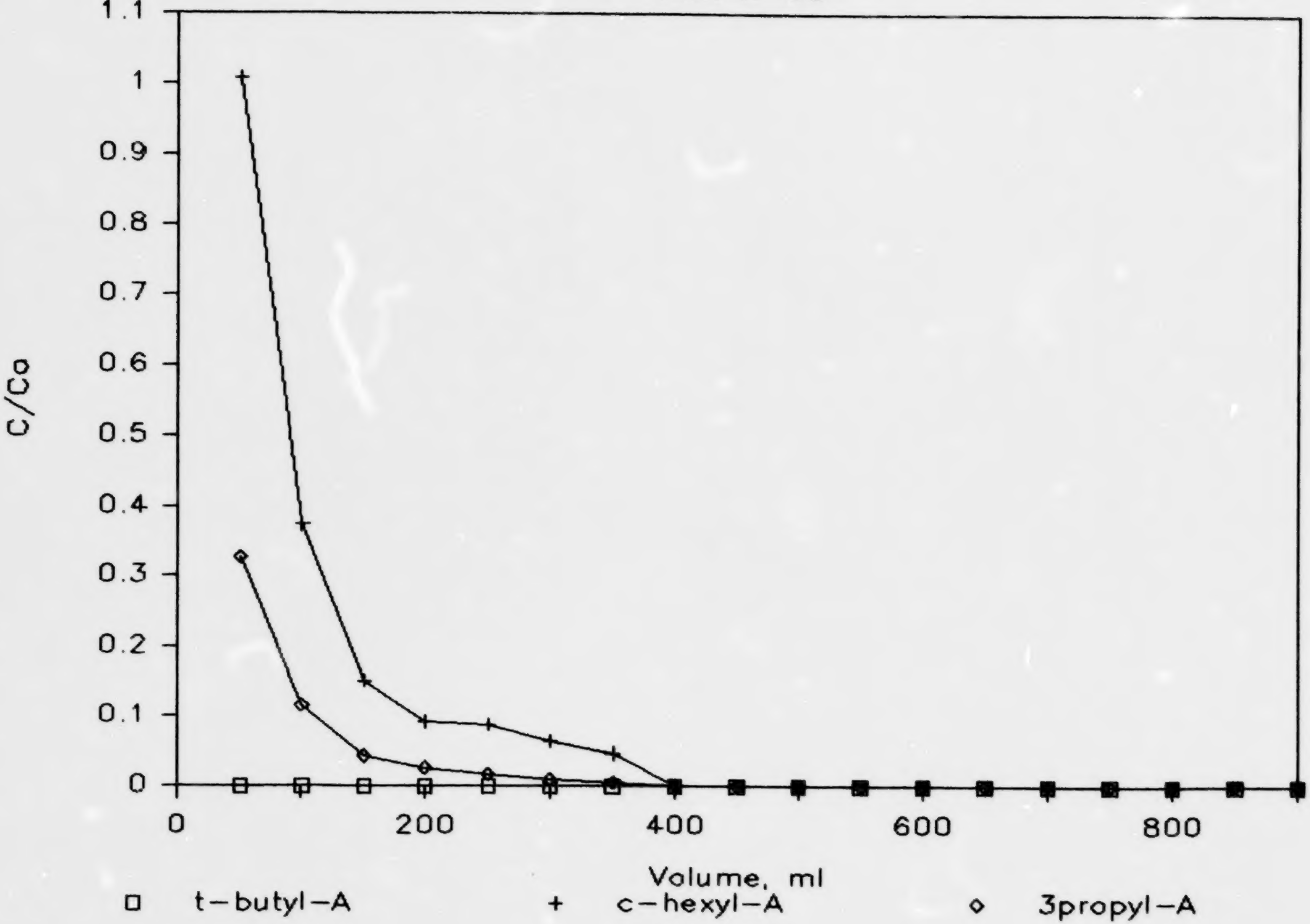


N-COMPOUNDS BREAKTHROUGH CURVES



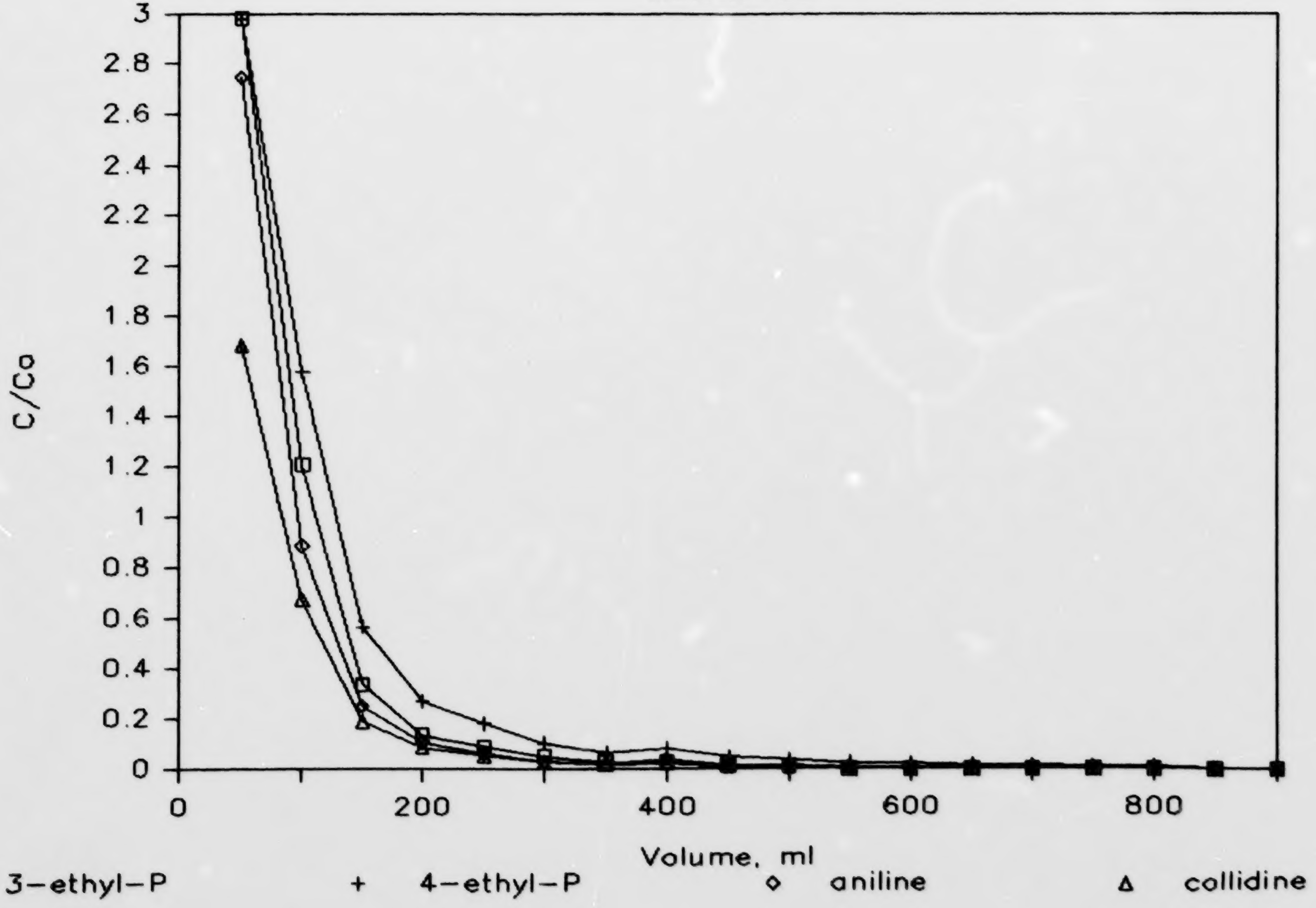
N-COMPOUNDS DESORPTION CURVES

RUN R-68



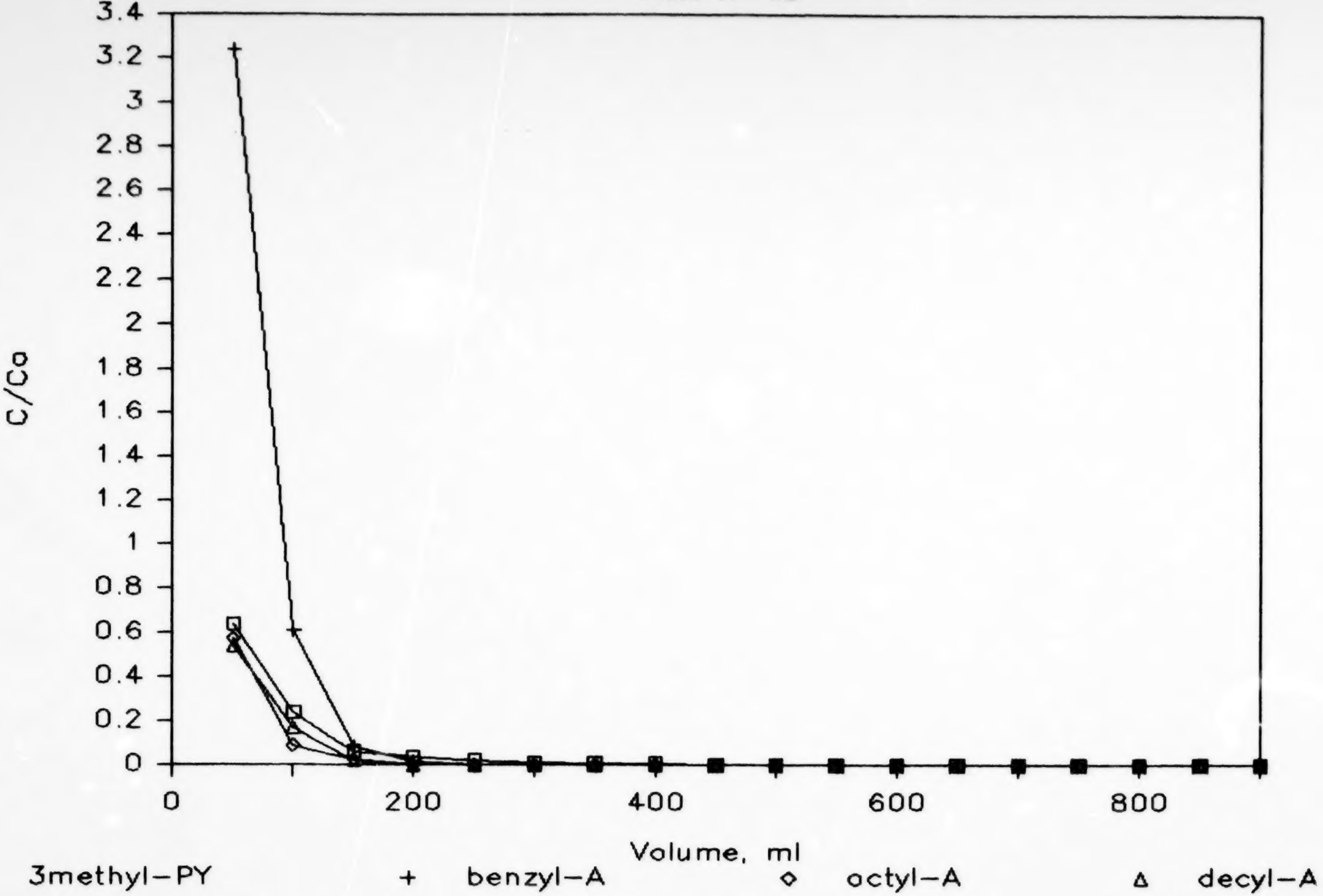
N-COMPOUNDS DESORPTION CURVES

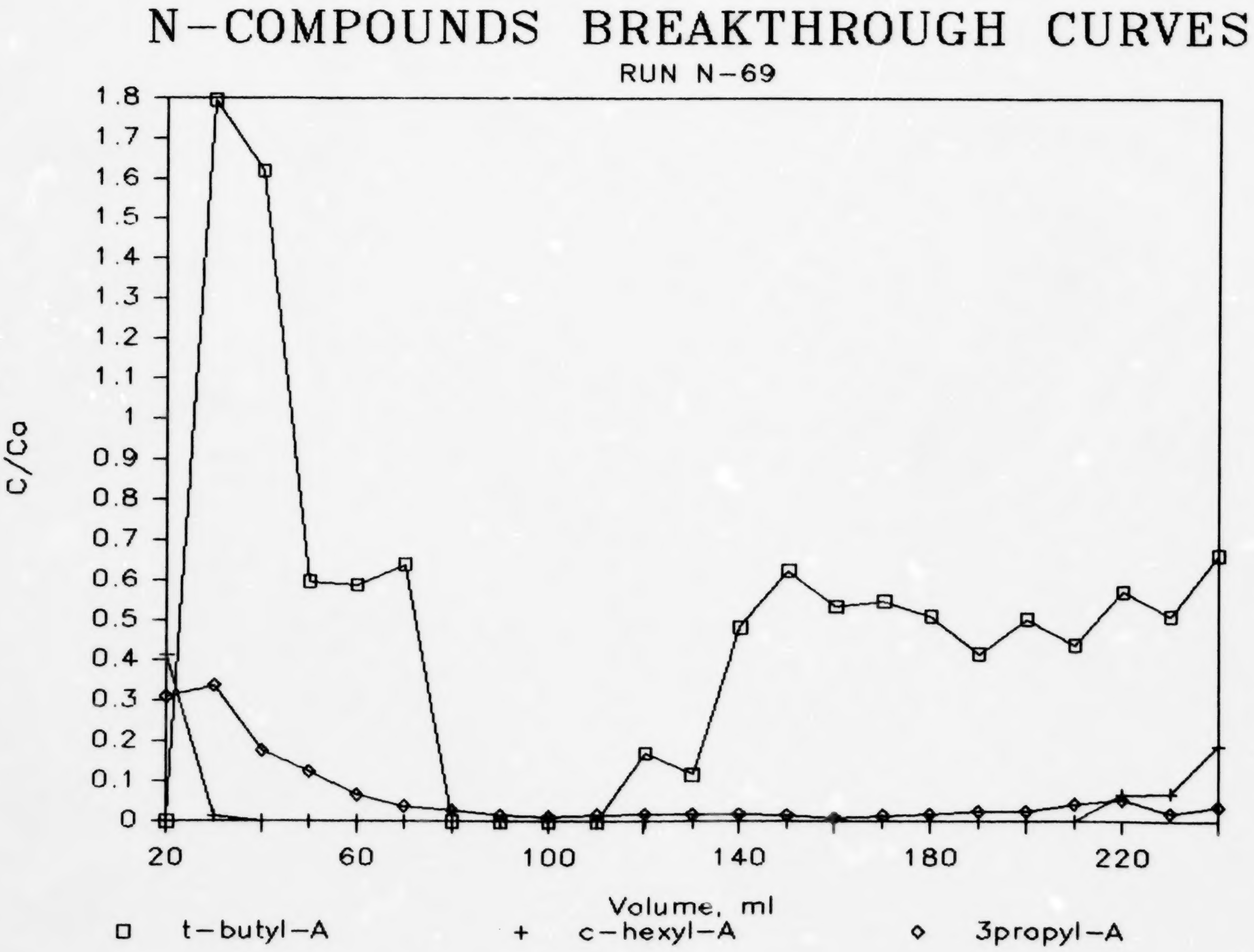
RUN R-68



N-COMPOUNDS DESORPTION CURVES

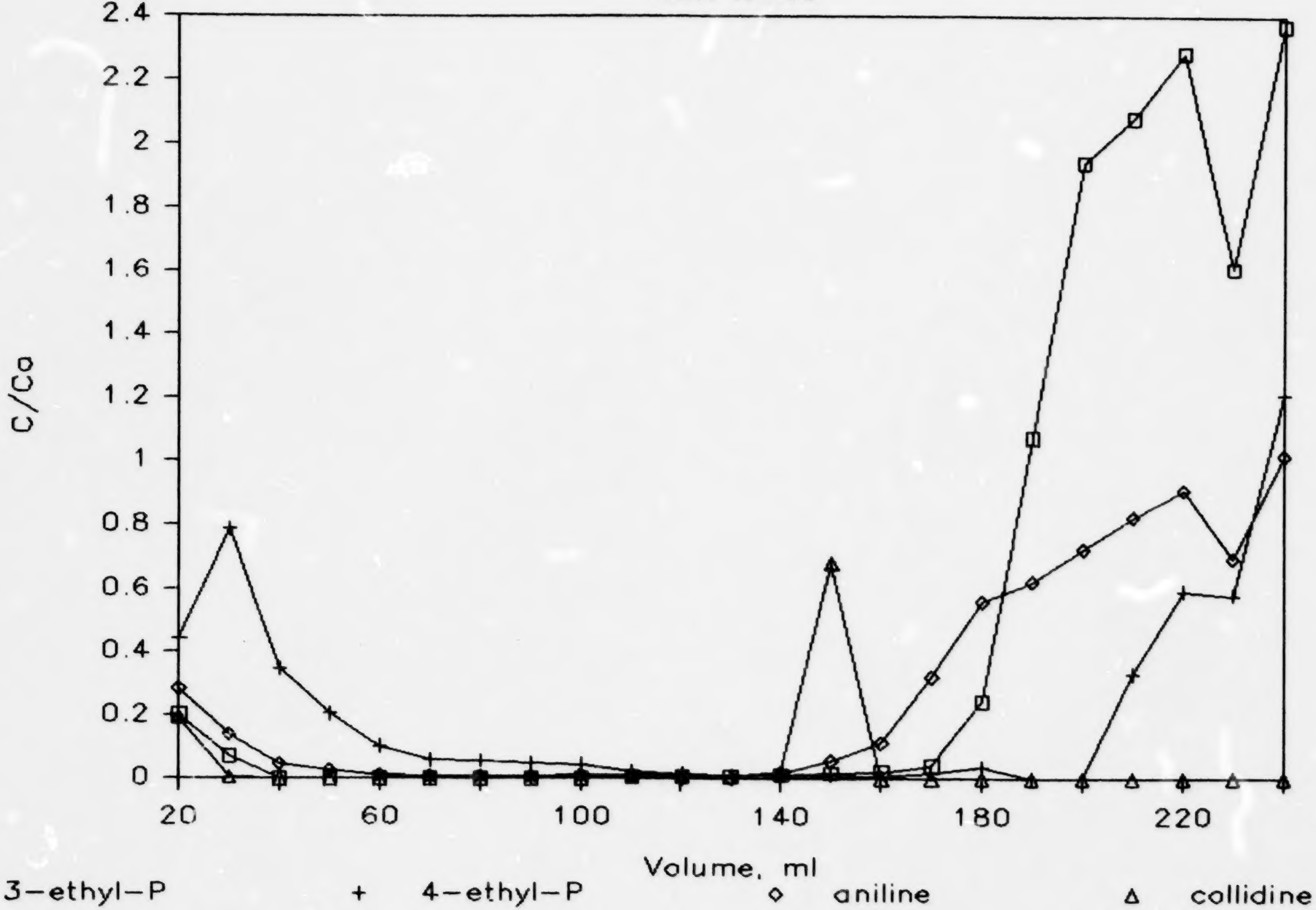
RUN R-68




N-COMPOUNDS BREAKTHROUGH CURVES
RUN N-69
C/Co
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
20
60
100
140
180
220
Volume, ml
□ t-butyl-A
+ c-hexyl-A
◇ 3propyl-A

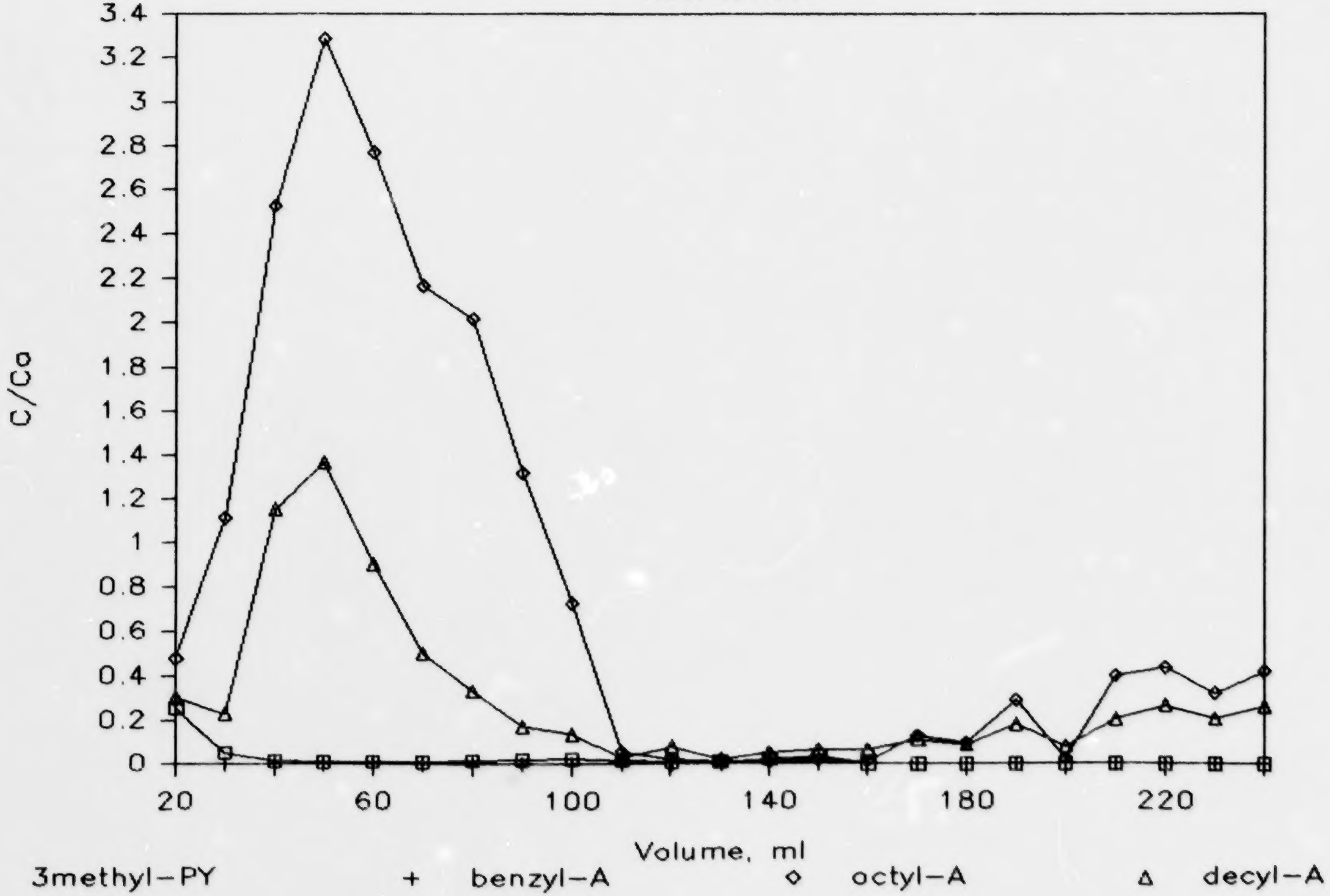
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-69



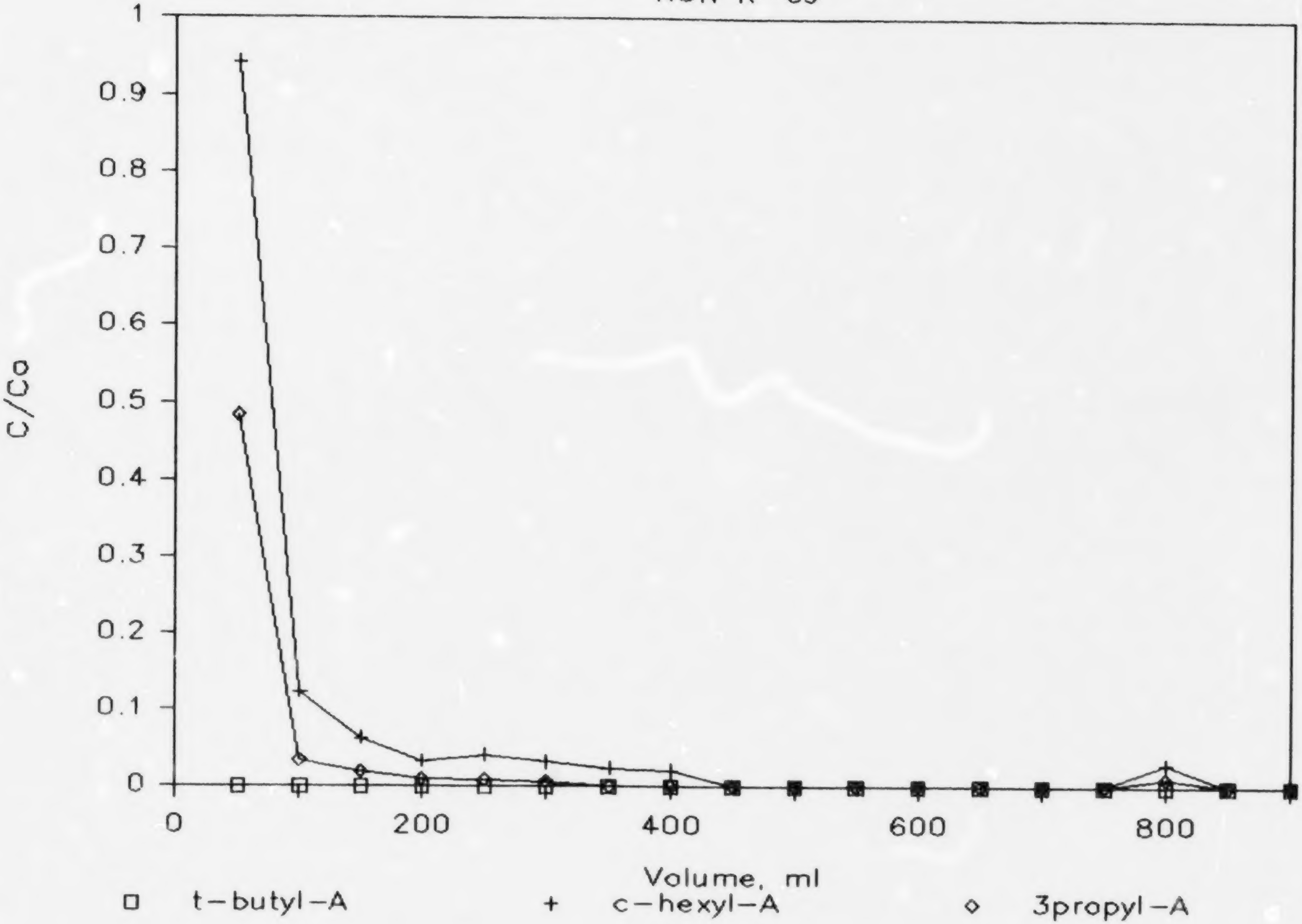
N-COMPOUNDS BREAKTHROUGH CURVES

RUN N-69



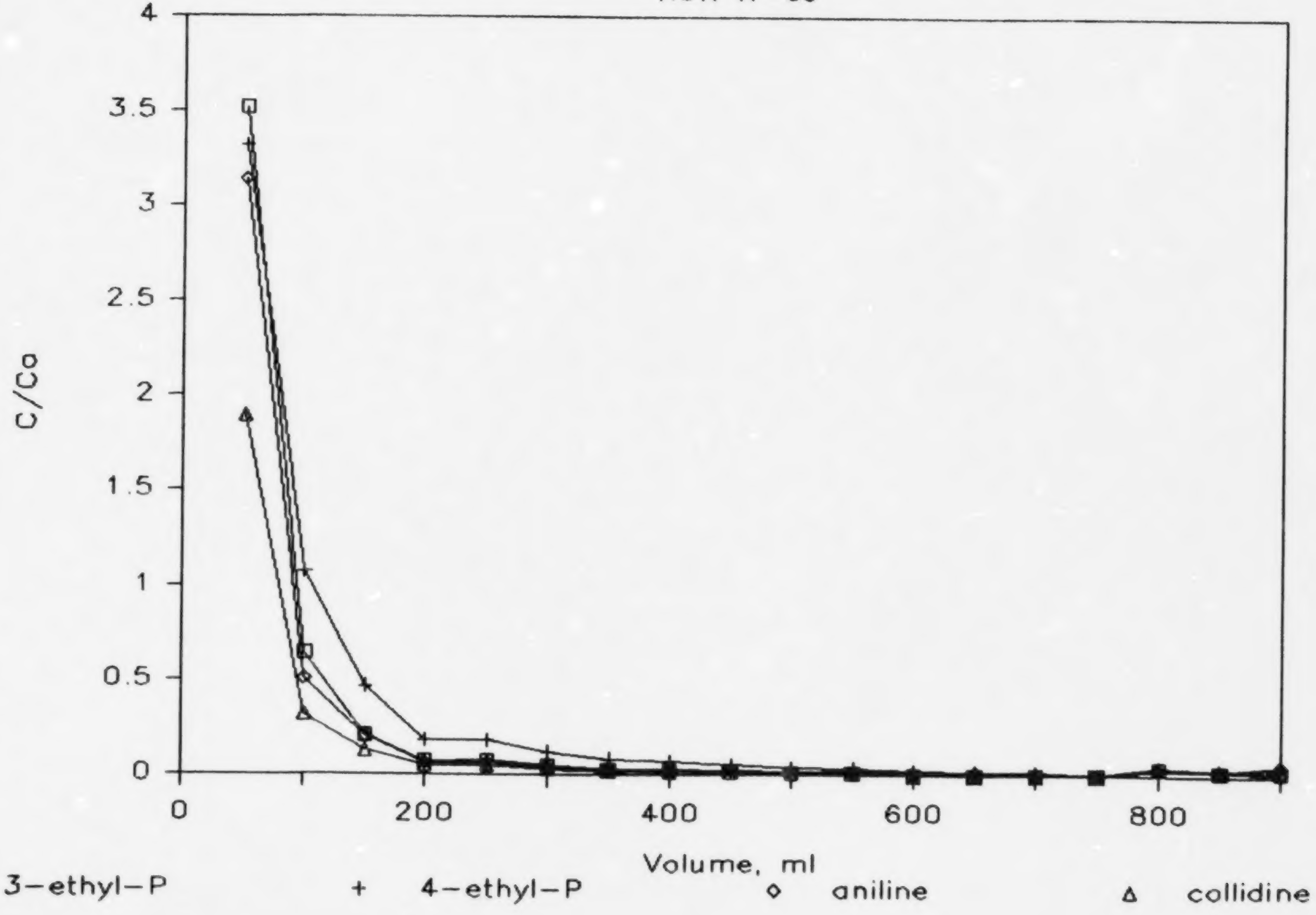
N-COMPOUNDS DESORPTION CURVES

RUN R-69



N-COMPOUNDS DESORPTION CURVES

RUN R-69



N-COMPOUNDS DESORPTION CURVES

RUN R-69